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OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT

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Memoirs of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. XXXVI.

THE PLAGIOSTOMIA.

(SHARKS, SKATES, AND RAYS).

BY

SAMUEL GARMAN.

WITH SEVENTY-SEVEN PLATES.

TEXT.

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THE PLAGIOSTOMIA (SHARKS, SKATES, AND RAYS). By Samuel Garman.
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THE PLAGIOSTOMIA.

(SHARKS, SKATES, AND RAYS.)

INTRODUCTION.

The purposes of this Memoir are to make additions to knowledge of the Sharks, Skates, and Rays (Plagiostomia) and to present the subject in such a manner as will be most useful to the greatest number of students. If in furtherance of these intentions it is found that there has been some elimination or apparent neglect of particular special advances in the science it is to be remembered that the latter being technical appeal more directly to the few specialists than to the much greater number of general inquirers. The work is necessarily a revision; and being a revision, however original, that begins at the same sources, and treats of the same material, literary or other, as a classical work like that of Müller and Henle, 1841, it must of necessity be to a great extent confirmatory in its results; and it must either begin at the same sources and go over the grounds traversed by the earlier authors or it must accept their conclusions. Going over the entire field as is done here discovers many occasions for difference of opinion. This is most true in the nomenclature and synonymy. Happily there has been a somewhat general agreement among zoölogists in regard to nomenclature of animal species that it is not advisable to go farther back, or to earlier dates, than 1758, the date of the tenth edition of the "Systema naturae" of Linné; but unhappily a few writers prefer to select their authorities, later than Linné, as binomial or nonbinomial rather than to accept the earliest, after 1758, properly formed and bestowed binomial names by whomsoever made and applied. The selection of one authority because he favored binomials more than another has led to much uncertainty among names and to many changes. It has led authors to belittle and ignore excellent works which at their time of publication and much later ranked in accuracy and influence among the first of the scientific publications of their period. In support of this, two works to

which various references are made below may be cited: — the "Dictionnaire raisonné universel d'histoire naturelle" by Valmont de Bomare, Paris, 1765, republished in several editions (the second, 1768, a four volume quarto being used here), and the "Neuer schauplatz der natur nach den richtigsten beobachtungen und versuchen in alphabetischer ordnung durch eine gesellschaft von gelehrten," Leipzig, 1775–1781 in ten volumes octavo, both of which works for their excellence in the time of publication, soon after the appearance of Linné's works, and for their aid in the diffusion of scientific knowledge deserve much from the scientist. In choosing a nomenclature it is better to take from such works the binomials correctly formed and applied than to accept them years later from writers inspired by the same books. The "Schauplatz" referred to above is anonymous, it is true, but it gives the authorities for its generic and specific names and thus its citations amount to republication after 1758 by the original authors, previous as the first publication may have been. With due regard to the more generally accepted rules of priority and publication since 1757, the generic name of an animal applied in 1758 or later and accompanied by a pertinent diagnosis or by a named characterized and recognizable species is used in these pages without question of its author's standing as a binomialist. This limits attention to the merits of the diagnosis and prevents the interminable discussions of those of its author.

The following notes will explain certain adoptions and changes.

Chondropterygii.— This term is used by Linné, 1735, Artedi, 1738, Gronow, 1754–63, Gmelin, 1789, and Walbaum, 1792; the names for its subdivisions Chismopnea and Plagiostomia and for the subdivisions of the Plagiostomia, the Antacea and the Platosomia, are from Rafinesque, 1815, as is set forth at greater length in the publication on the Chimaeroids, Garman, 1904, Bull. M. C. Z., **41**, p. 269.

Hexeptranchidae.— Heptranchias and Hexanchus are generic names given by Rafinesque in 1810 to sharks having seven and six pairs of gill openings respectively. These genera were thrown together by Cuvier, in 1817 and 1829, in his genus Notidanus, from which authors have formed the name Notidanidae. Notidanus being reduced to the synonymy the name Notidanidae loses its pertinence. A later family name, Hexanchidae, used by some authors is not well adapted for inclusion of a seven-gilled genus, and similarly Heptranchiidae should not include a six-gilled genus. To obviate these objections a portion of the name of each genus is used to form the word Hexeptranchidae.

CARCHARIAS.— This genus was characterized by Rafinesque, 1810, from the species *C. taurus* Raf., 1810; it is retained here as originally introduced. Carcharias Cuvier, 1817, belongs to a different family; it is a synonym of a Carcharinus Blainville, 1816.

VULPECULA.— Valmont, 1768, gives a description of *V. marina* of earlier authors. His species is *Squalus vulpinus* Bonn., 1788, the *Alopias macrourus* Raf., 1810, *A. vulpes* Bonap., 1841. The genus and the species are adopted from Valmont.

RHINCODON.— Smith, 1829, describes this genus from the species *R. typus* Smith, 1829. Rineodon, Rhineodon, Rhinodon, and Micristodus are synonyms.

CATULUS.— *Catulus saxatilis* Valmont, 1768, equals *Squalus stellaris* Linné, 1758. The name of the genus is retained; the type species is given the earlier name.

SCYLIORHINUS.— In this subgenus of Squalus Blainville, 1816, placed twenty-two nominal species. After types of eight genera, Catulus, Poroderma, Cephaloscyllium, Pristiurus, Stegostoma, Ginglymostoma, Orectolobus, and Chiloscyllium, have been removed there remain a half dozen or more of the species not yet fully recognized, sufficient to prevent the adoption of the name for a genus of different inclusions. Scyllium Cuvier, 1817, was founded on species of Catulus Valmont, 1768. Σκύλια, caniculae, dog-fish.

GALEORHINUS.— This genus is adopted from Blainville, 1816, with the first of the six nominal species (of four genera) included by him as the type, *G. mustelus* Linné sp. (part).

MUSTELUS.— Because of diverse applications this name is not adopted. In the feminine it was used by the earliest writers for both mammals and fishes. It was used thus by Pliny. Jovius, 1524, applied it to a lamprey and states its use among the Galei. Wotton, 1552, used it for a mammal and also mentions "Galeus laevis vel Mustelus." Belon, 1553, p. 67 gives the name to a number of sharks, on p. 75 to a lamprey, on p. 129 to a gadoid fish, and on p. 69–70 he describes and figures *Mustelus spinax*, a species now in the genus Squalus. Later authors show a similar diversity. Linné gave the name Mustela to the mammal in 1735, 1758, and 1766. Valmont's 1768, *Mustela vulgaris* "du genre des morues," 3, p. 178, was too late to hold. His "Mustelus, espece de chien de mer," "C'est le *galeus stellatus* des Auteurs," that is *Squalus mustelus* Linné. Under the name stellatus it appears as *Galeus stellatus* Duhamel, 1777–1782, with its ally *Galeus laevis*, 3, section 9, p. 300. If desirable to retain the name Mustelus for the Shark it should be on the authority of Valmont, 1768, rather than on that of Linck, 1790.

GALEUS.— "Cagnot bleu, *Galeus glaucus*" appears, with a description, on page 371 of the first volume of Valmont's work. Adopting this name for the genus, the type is *Squalus glaucus* Linné, 1758. This anticipates the use of Galeus by Rafinesque, 1810, for the genus later named Pristiurus by Bonaparte, 1832, or that by Cuvier, 1817, for species which had no generic name properly their own before that by Gill, 1864, Eugaleus.

CARCHARINUS.— Under this name, as a subgenus of Squalus Blainville, 1816, placed fourteen species. The first of these *C. commersonii* was known from a recognizable figure by Lacépède, 1798, of Le Squale Requin, **1**, pl. 8, f. 2, which, with part of the description, leaves no doubt of the generic characters of the young specimen figured. This figure served as the original of Blainville's species *C. commersonii*, as asserted by him on page 90 of the Faune Française, Poissons.

CESTRACION.— This genus is from Klein, 1776, as reprinted in the Schauplatz, **3**, p. 524, with the type species *Squalus zygaena* Linné, 1758. Walbaum, 1792, Art. Gen. Pisc., p. 580, also gives the genus from Klein including the species *Squalus zigaena* and *S. tiburo* of Linné.

CENTRACION.— This name was given to one of the Port Jackson Sharks by Gray, 1831, in the first number of his Zoological miscellany, p. 5. The entry is "Zebra Centracion. *Centracion zebra* n. s."; it is followed by the description of a species accepted as valid by authorities generally. Heretofore it has been taken for granted that Centracion was a mistake or a misprint for Cestracion, the latter as applied by Cuvier, 1817, to the Port Jackson Shark. Cuvier did not, as usual, give a derivation of his generic name; and there is a possibility that Cestracion is an error, since neither κέστρα, a hammer or pickaxe, nor κέστρον, an instrument for engraving, is especially pertinent. It may have been that Gray intended substituting Centracion for Cestracion, the latter having been used in the Schauplatz, 1776, and by Walbaum, 1792, from Klein, for the Hammer-Head Sharks. However this may have been, the question that concerns us is whether it is better to conjecture a reason for the existence of Centracion or to accept the fact, and use the word if available. The latter alternative is preferred. The word does not appear to have been preoccupied; it is sufficiently correct in form, is better in signification than Cestracion, and it is accompanied by the description of a firmly established species. In all respects it compares favorably with any one of a number of generic names proposed by the author of Centracion. Cestracion was derived from κέστρα and ἀκίς;

Centracion derives from κέντρον and ἀκίς, or possibly κίων, and is better suited to the genus. An earlier name for the Port Jackson Sharks, Heterodontus, had been bestowed by Blainville, 1816, in disregard of the fact that Heterodon, identical in derivation, was applied by Latreille, 1802, to a genus of snakes. Blainville is followed by some authors, but, as his name is preoccupied in snakes, and as Cuvier's name, Cestracion, had been applied to a very different genus of sharks, Centracion becomes the earliest substitute as a generic name for the Port Jackson Sharks. It is not found that Gray made any explanations. He wrote Cestracion instead of Centracion in his synonymy when, in 1851, he adopted the name Heterodontus for the genus; having dropped the name Centracion explanations were unnecessary. The apparent displacement in the earlier literature of recent and fossil forms is not as great in the change to Centracion, as would appear in the use of Heterodontus, Tropidodus, or Gyropleurodus of later dates.

Acanthidium.— As published by Lowe, 1839, in Proc. Zool. soc. London, p. 92, this genus contained two species, *A. pusillum* and *A. calceus*. The first was a species of Etmopterus Raf., 1810; its removal from Acanthidium left *A. calceus* the type and only known species of the genus.

Dalatias.— This is not recognized as a genus. Rafinesque, 1810, gave as a principal character no spiracles. Under the name he placed two species; one of which was possibly a species of Squalus, with spiracles and dorsal spines; the other has not been identified from the description and the figure. It has a large first dorsal near the pectorals, a small second dorsal distant from the ventrals and is without spiracles. Bonaparte, 1846, suggested that Dalatias might have been the genus named by himself Scymnorhinus, and Gray, 1851, and others following him, adopted the suggestion; but *Scymnorhinus licha* Bonn. and Bonap., the species under consideration, has a small first dorsal behind the pectorals, a larger second dorsal, above the ventrals, and has spiracles, sufficient reasons to discredit the identity.

Rhina.— Klein's genus Rhina, 1742, Hist. pisc. miss., 3, p. 13, and 1776, Schauplatz, 2, p. 587, and of Walbaum, 1792, Art. Gen. Pisc., p. 580, had for its type *Squalus squatina* Linné, 1758. The name Squatina was used instead of Rhina by Valmont, 1768, but without mention of a type.

Rhinobatus.— Klein's Rhinobatus, 1742, Hist. pisc. miss., 3, p. 32, and 1776, of the Schauplatz, 2, p. 593, was drawn from Aristotle, Pliny and others by way of Columna, 1744, Phytob., p. 101, pl. 27 (Ῥινόβατος sive Squatinoraia, on the plate). The reference in the Schauplatz fixes the type as

Raia rhinobatos Linné, 1758. Wälbaum, 1792, gives the genus under the name Rhinobatus, refers to Klein, but does not name a type.

Narcacion.— Torpedo in early literature was a Latin vernacular name for animals known to Aristotle as Νάρκη. Pliny makes various mentions of the Torpedo as a cartilaginous fish, see Lib. IX, C. 24, c. 42. Albertus Magnus, in the edition of 1495, Lib. 24, f. 245, speaks of the Torpedo and its properties. Jovius, 1524, c. XXVIII, applies the name to the five-spotted species of the Mediterranean. Wotton, 1552, in the course of his article on Torpedoes, f. 145, remarks "Sunt qui duo torpedinis genera tradunt: marinum scilicet et fluviatile." Belon, 1553, describes and figures two of the marine species. Salviani, 1554, f. 142, says "Omnes, qui de Torpedine loquuti sunt, eam marinam solum fecerunt, uno deopto Athenaeo, qui fluviatilem etiam, Nili scilicet accolam, eam esse asseverat." Rondelet, 1554, treats of the Mediterranean species and cites Athenaeus and Strabo as authorities for the existence of a Nile Torpedo. Gesner, 1558, figures several of the Torpedoes. Aldrovandi, 1613, Pisc., p. 415–423, discusses the Torpedoes and gives two plates to the maculosa and the nonmaculosa. Cuba, 1536, Hortus, Pisc., lib. 3, c. 62, fol. 85, makes use of the name Narcos for the Torpedoes. Klein, 1742, Hist. pisc. miss., **3**, p. 31, gave the generic name Narcacion to the marine species of Artedi's, 1738, "raia tota laevis," from Rondelet, 1554. The Schauplatz, 1777, **4**, p. 726, brings Klein's Narcacion among the binomials by referring for its type to the *Raia torpedo* of Linné, 1758, as also Walbaum, 1792, Art. Gen. Pisc., p. 580, who has but one species, *Raia torpedo*, in the genus. The two species in *Raia torpedo* as it was left by Linné had been separated by Müller, 1774, when he figured the five-spotted *R. torpedo* without directly crediting it to Linné. At the hands of Risso, 1810, the second species received a name, *Torpedo marmorata*. The electric rays were separated, under Torpedo from the Raiae, the "eigentlyke Rochen," by Houttuyn, 1764, without mention of type species. Valmont, 1768, also applied Torpedo to the proper group without indicating a type. Forskael, 1775, was in error in describing the fish now known as *Malapterurus electricus* Linné, Lacépède, as *Raia torpedo* but in an observation at the end of his description he remarks that it may be a new genus to which he indirectly applies the name Torpedo. Torpedo of Duméril, like that of Houttuyn had no type and, following Forskael's Torpedo, has less reason for existence. Risso, 1810, apparently was the first to supply the type for the genus Torpedo under that name. It does

not appear that anything would be gained in favor of a stable nomenclature either by adopting the genus from Risso or from the next in order, Blainville, 1816, who changes the name to Narcobatus. As Narcacion has been applied only to the electric rays and as it was the first generic name given to the genus with a type after 1758, it has been recognized in the present work.

Dasybatus.— Klein, 1742, Hist. pisc. miss., 3, p. 34, founded this genus and placed in it as the first species "*Pastinaca marina*, quae Dioscoridis; Fab. Columnae. Willughby Tab. D. f. 3." This species is the "*Pastinaca marina* Dioscoridis Tab. 28 of Columna, 1592 and 1744 in the Phytobasanos, p. 105 of the reprint. Plate 28 also bears the names Τρυγών Θαλασσία Squatinoraia, whence *Trygon thalassia* Müller and Henle, 1841, and of Günther, 1870. In the Schauplatz der natur, 1775, 1, p. 992, Dasybatus of Klein reappears and its first species is "Pastinaca Marina des Dioscoridis, Fabii Columnae. Willughby, Tab. D. 5, fig. 3," which figure is reproduced from that of Columna. This species was unknown to Linné, or was confused with his *Raia pastinaca*, 1758. Walbaum, 1792, republishes the genus without naming the species; in 1793, Ichthyol. Enod., p. 35, the species is given as "*Raia pastinaca* L. S. N. 396" (1766) which included more than one species; he also cites plate 82 of Bloch, which represents *Dasybatus pastinacus* and not *D. marinus*. Instead of Dasybatus from Klein in the Schauplatz, and from Walbaum, some prefer to take Dasyatis from Rafinesque, 1810, for these sting rays, claiming that the earlier name was not regularly established. Dasyatis of Rafinesque was first published in his work "Caratteri di alcuni nuovi generi, etc., p. 16; it included but one species, *Dasyatis ujo* Raf. In a later work, the Indice of the same year, he took his *D. ujo* and made a new genus of it, Uroxis, naming the type *Uroxis ujus*, Indice, p. 48. After this he founded the genus Dasyatis again on another type, *Raia pastinaca* Linné, 1758. In other words Rafinesque took its only species out of the genus Dasyatis to make a new genus and afterward made another new genus under the old name with a new type species, Indice, p. 49. It is very evident he did not consider *Uroxis ujus* to be congeneric with *Dasyatis pastinaca* Linné, Raf. *Dasyatis ujo*, actually the type of the genus Dasyatis, has never been recognized; no known species of Dasybatus agrees with its description; consequently it seems better to leave Dasyatis with its type, the only species, until it can be determined. On the other hand there is no doubt concerning *Dasybatus*

marinus of Klein, later named *Trygon aspera* by Cuvier, 1817, and here identified with *Raia centroura* of Mitchill, 1815, and *Trygon thalassia* of Müller and Henle, 1841, from Columna. The name Trygon was applied to this genus by Cuvier, 1817, from an unpublished work of Adanson, 1844 to 1845, Cours d'hist. nat., 2, p. 170. The genus Trygon of Cuvier, that is the genus Dasybatus, contained species that are types of several different genera. These having been removed, the genus, under the earlier name, Dasybatus, is found to contain subgenera to which various names have been applied. Rüppell, 1828, in Atl. reise N. Afrika, p. 51, gave the name Pastinachus to a subdivision containing two species, *Trygon lymma* (*Raia lymma* Forsk., 1776) and *Trygon sephen* (*Raia sephen* Forsk., 1776) characterized by a fin fold wholly or partly subtending the tail. Rüppell, 1835, took the name Pastinachus, for a species wholly without fin folds, *D. uarnak*. As he could not by accepted usage make such a change, the name must be retained with at least one of the species originally included. Müller and Henle, 1837, took the species without traces of fin folds, *D. uarnak*, for their division Himantura, and, disregarding Rüppell's earliest arrangement, took one species of Pastinachus, *P. lymma* for the type of their genus Taeniura while the other, *P. sephen*, was placed as the type, and only species, of a new genus, Hypolophus. The latter is not generically distinct; its type remains in Dasybatus, the type of a subdivision under the name originally bestowed by Rüppell, 1828. The recognized sections of Dasybatus are (1) Himanturus Müller and Henle, 1837, without fin folds or keel on the tail, (2) Pastinachus Rüpp., 1828, with a fin fold below the tail, equal Hemitrygon Müller and Henle, 1838 and Hypolophus Müller and Henle, 1837, (3) Dasybatus with a keel above the tail and a fin fold below, as in *D. pastinacus*, and (4) Amphotistius, the species of which have fin folds on the tail both above and below, as in *D. sabinus* and *D. kuhlii*.

Myliobatis.— Cuvier, 1817, founded this genus on *Raia aquila* of Linné, 1758, a species not placed in Aëtobatus by Blainville, 1816; thus the two genera cannot be synonymous.

Aëtobatus.— Blainville, 1816, listed eleven species. From these authors commonly have chosen *Raia narinari* Euph., 1790, as the type. Restricted to *A. narinari* and its closest allies, there is no conflict with Myliobatis Cuv.

Mobula.— Rafinesque, 1810, Ind. itt. Sic., p. 48, 61, founded this genus on *Raia mobular* Lacépède, 1798, Poiss., 1, p. 151. The type is that named *Raia mobular* by Bonnaterre, 1788, Ichth., p. 5, with references to Duhamel's

description and figure. It anticipated Dicerobatus Blainville, 1816. Cephalopterus Risso, 1810, had been preoccupied. Aodon of Lacépède, 1798, was founded on toothless sharks *Squalus massasa* and *S. kumal* mentioned by Forskael, 1775, and a toothless head described by Brunnich, 1768. The name is not appropriate; the species are unrecognizable, though there is a possibility that *Squalus edentulus* Brunn., renamed *Aodon cornu* by Lacépède, may have been the head of a species of Mobula or of Manta.

SYSTEMATIC DESCRIPTIONS.

Chondropterygia.

This class contains fish-like vertebrates with a skeleton that is more or less completely cartilaginous, with six to eight branchial arches, with fins having cartilaginous basal supports and fibrous extensions, with teeth not implanted in the jaws, with spiral folds in the intestine, and with internal fertilization of the eggs. There is no air bladder; the males have paired intromittent organs; and the embryos have deciduous external gills.

Two orders may be separated as follows: —

An erectile dorsal spine; vertebrae undifferentiated
one external gill opening; teeth few, plate-like . . . *Chismopnea*
No erectile dorsal spine; vertebrae more or less differentiated
five or more gill openings; teeth numerous . . . *Plagiostomia*

CHISMOPNEA.

Body elongate, tapering to a point in the tail; erectile spine of the dorsal above the shoulders; pectorals free. Mouth inferior; upper jaws fused with the skull, lower directly articulated to it; four upper and two lower teeth. Hemispheres of the brain distant from the optic lobes. Eggs incased in a fibrous horny shell; embryo hatched after extrusion of the egg. Male with a frontal tenaculum, with ventral tenacula and with claspers.

For a systematic account of this order see Garman, 1911, Memoirs M. C. Z., 40, p. 79–102. The three families recognized may be distinguished thus: —

Notochord with narrow rings
snout not produced, short . . . . . *Chimaeridae*
snout produced in a long pointed rostrum . . *Rhinochimaeridae*
Notochord without narrow rings
snout produced in a leaf-like appendage . . . . *Callorhynchidae*

PLAGIOSTOMIA.

The Plagiostomes, Sharks, Skates, and Rays, are distinguished from the Chismopnea by the presence of from five to seven external gill openings and the absence of an erectile dorsal spine, and, in the males, by the lack of a frontal tenaculum and of subventral tenacula.

The Plagiostomia are divided into two suborders: —

Body subfusiform; pectorals not attached to the head
gill openings at the side of the body . . . *Antacea* (page 10)
Body discoid; pectorals attached to the head
gill openings below the disk . . . . . *Platosomia* (page 257)

ANTACEA.

Body fusiform to subcylindrical. Pectoral fins free from the head, with short basal articulations and comparatively few radials; shoulder girdle not directly or firmly attached to the vertebral column. Dorsal fins one or two, without or with a fixed spine in front. Anal fin present or absent. Nostrils separated from the mouth or connected with it by grooves. Eyes lateral, without or with a nictitating membrane or fold. Spiracles present or absent. Mouth inferior or anterior; teeth numerous. Five to seven gill openings, in front of the pectorals or above them. Hemispheres of the brain not distant from the optic lobes. Name from Ἄντα & ἀκίς.

Synopsis of Groups of Families.

Body subcylindrical
one dorsal, without a fixed spine; an anal fin; caudal axis low
gill openings six to seven; no nictitating membrane
spiracles present . . . . *Hexanchoidei* (page 11)
two dorsals, without spine; an anal fin
gill openings five; caudal axis low
spiracles present; no nictitating membrane
Carcharoidei (page 11)
gill openings five; caudal deep, axis raised
spiracles present, rarely absent; no nictitating membrane
nasoral grooves none . . . *Isuroidei* (page 12)
two dorsals (except on *Pentanchus*), without spine; an anal

gill openings five; caudal axis little raised; no nictitating membrane
spiracles present; nasoral grooves present or absent
Catuloidei (page 12)

two dorsals, without spine; an anal; caudal axis slightly raised
gill openings five; a nictitating membrane
spiracles present
nasoral grooves absent (except on *Scylliogaleus*)
Carcharhinoidei (page 12)

two dorsals, with fixed spine; an anal; no nictitating membrane
gill openings five; teeth raptorial and molarial
spiracles present; nasoral grooves present . *Centracoidei* (page 13)

two dorsals, with or without a fixed spine; no anal fin
gill openings five to six; no nictitating membrane
spiracles present; teeth raptorial to sectorial; no nasoral grooves
Squaloidei (page 13)

Body and head depressed; mouth anterior; teeth raptorial
two dorsals, on the tail, without a fixed spine; no anal
gill openings five; pectorals produced, but free from the head
Rhinoidei (page 13)

Synopsis of Families.

Hexanchoidei.

One small spineless dorsal fin; an anal fin; caudal long, axis low; 6 to 7 gill openings

six gill openings, anterior covers crossing the throat
teeth with three long sharp cusps; mouth anterior
Chlamydoselachidae (page 13)

six to seven gill openings, covers not crossing the throat
teeth compressed, blade-like, notched on the edges; mouth inferior
Hexeptranchidae (page 15)

Carcharoidei.

Two spineless dorsals; a large anal; five gill openings; no nictitating membrane
snout pointed, short to very long; caudal large, axis low; spiracles present
teeth with a long slender cusp and a two-rooted base
Carcharidae (page 23)

ISUROIDEI.

snout conical; spiracles present; caudal very long, axis rather low
teeth triangular, compressed; no nictitating membrane; no caudal keels
Vulpeculidae (page 30)

snout subconical; spiracles absent or minute; tail with keels and pits
caudal axis much raised, lower lobe produced; mouth inferior
Isuridae (page 31)

snout broad; spiracles small; tail and body with lateral folds or keels
caudal axis much raised, lobe produced; teeth many, minute
Rhincodontidae (page 41)

CATULOIDEI.

snout depressed; body short; tail without keels and pits; spiracles present
caudal long, axis little raised, lower lobe not produced
nasoral grooves and nasal cirri present; anal small
Orectolobidae (page 43)

caudal short, axis not raised, lower lobe not produced; nasal cirri absent or present
nasoral grooves absent or rudimentary . *Catulidae* (page 68)

snout broad, depressed; body long; first dorsal in advance of ventrals; spiracles present
caudal short, axis little raised, lower lobe not produced; mouth very large
nasoral grooves absent; teeth many, minute, 3–5 cusped
Pseudotriakidae (page 103)

CARCHARINOIDEI.

Two spineless dorsals, first above the body; an anal; 5 gill openings; tail with pits and a produced subcaudal lobe
snout depressed; spiracle absent or present; no nasoral grooves; a nictitating membrane
teeth compressed, triangular, one series in function
head not expanded across the orbital region
Carcharinidae (page 106)

head much expanded across the orbital region
Cestracionidae (page 155)

snout depressed; spiracle present or absent; a nictitating fold
teeth in bands or pavements, more than one series in function
Galeorhinidae (page 162)

CENTRACOIDEI.

Two dorsals each with a fixed spine; an anal; spiracles; nasoral grooves
snout short; mouth narrow, lobed and folded; caudal short, axis raised
teeth raptorial in front, molarial backward
Centraciontidae (page 180)

SQUALOIDEI.

Two dorsals each with a spine; no anal; spiracles; no nasoral grooves
snout moderate to long; mouth protrusible, with a deep groove at each angle
teeth compressed, sectorial to cuspidate . . *Squalidae* (page 188)
Two spineless dorsals; no anal; no nictitating fold; spiracles present
snout short; tail without pits or keels; mouth inferior, with grooves and folds
teeth raptorial on upper jaw, sectorial on lower
Scymnorhinidae (page 233)
snout short, broad; dorsals small, behind the body; caudal axis raised
teeth sectorial on both jaws; no nasoral grooves;
Echinorhinidae (page 242)
snout greatly produced, with sharp teeth on its edges and with barbels
teeth on the jaws small, a number of series in function; 5–6 gill openings
Pristiophoridae (page 244)

RHINOIDEI.

Two dorsals, without spines; no anal; head and body depressed
snout very short; pectorals expanded, free from the head; dorsals on the tail
mouth wide, anterior; spiracles present; tail keeled at each side
Rhinidae (page 248)

CHLAMYDOSELACHIDAE.

Body elongate, slender. Head broad, depressed. Eyes lateral, without a nictitating membrane. Nostrils distinct from the mouth. Mouth anterior, without labial folds; teeth with broad, backward-extended bases and slender cusps. Spiracles small. One dorsal, not preceded by a spine. An anal fin.

No pits at the root of the caudal. Margin of first gill cover free across the isthmus. Intestine with a spiral valve. Pterygoquadrate not articulated to postorbital process of the skull, hyomandibular elongate.

Chlamydoselachus.

Chlamydoselachus Garman, 1884, Bull. Essex inst., **16**, p. 52.

Six gill openings, margin of first free across the isthmus. Mouth very wide, longer than the skull, without labial folds. Teeth raptorial, similar in the two jaws, each with a broad base and three slender, curved, subconical cusps, with or without rudimentary cusps at their bases; no median teeth in the upper series; a median series on the symphysis below. Eyes lateral, elongate. Fins broad, caudal without a notch. *C. lawleyi* Davis occurs in the Pliocene of Tuscany.

Chlamydoselachus anguineus.

Plate **59**, fig. 4–5 (egg, embr.), fig. 6 (br. skel.); Plate **61**, fig. 7–8 (embr.).

Chlamydoselachus anguineus Garman, 1884, Jan. 17, Bull. Essex inst., **16**, p. 47, fig. 5, 1884, Feb. 1, Science, **3**, p. 116; 1884, Mar. 21, ibid., p. 345; 1884, Nov. 28, ibid., **4**, p. 484; 1885, July, Bull. M. C. Z., **12**, p. 1, pl. 1–20; 1885, Proc. Amer. assoc. adv. sci., **20**, p. 536; 1887, Mar. 18, Science, **9**, p. 267; 1888, Bull. M. C. Z., **17**, p. 82, pl. 15; 1899, Mem. M. C. Z., **24**, p. 41–44, pl. 70.

Didymodus anguineus Cope, 1884, Mar. 7, Science, **3**, p. 275; 1884, April, Amer. nat., **18**, p. 413; 1884, Proc. Amer. philos. soc., **21**, p. 412; 1884, May 30, Science, **3**, p. 645 (changes of name); 1884, Proc. Amer. philos. soc., **21**, p. 572.

Chlamydoselache anguinea Günther, 1887, Challenger rept. Zool., **22**, p. 2, pl. 64, 65; Dean, 1895, Fishes, living and fossil.

Body long, slender, subcylindrical, compressed behind the vent, which is behind the middle of the total length. Head broad, wider than high, slightly convex. Snout broadly rounded, hardly extending beyond the jaws. Nostrils lateral, behind the forward end of the mouth. Eye rather large, elongate, about midway from eye to end of snout, near a vertical from the mid length of the mouth. Spiracle very small, distance behind the eye about equal to distance from eye to end of snout. Mouth very large, extending as far backward as the skull; upper and lower jaws of equal length. No labial folds. Teeth small, similar in both jaws, several of each row in function; each tooth with three long, slender, curved, backward directed cusps. A small cusp at the base of the middle cusp is not always present. Bases of teeth broad, each with two prongs reaching backward beneath the base of the next tooth in the row. Upper jaw with fourteen rows on each side, no median row. A median row on the symphysis of the lower jaws with thirteen rows on each side of it. Pterygoquadrate attached to the skull in front of the postorbital process, between the eyes. Gill

openings six, very wide, oblique, in front of the pectorals; those of the two sides narrowly separated on the isthmus, which is crossed by the free margins of the first gill cover.

Pectorals moderate, broad, rounded. Dorsal small, base opposite and shorter than that of anal. Anal larger than ventrals, tip reaching origin of caudal. Caudal long, pointed, armed on upper edge by modified scales, subcaudal deep anteriorly, narrowing backward, not separated by a notch from the tip.

Uniform brown.

Details of anatomy are given by Garman, 1885, with numerous figures, and by Günther, 1887.

The type was taken in Japan, where the species is hardly to be considered rare. Collett, 1890, reports the occurrence of the species at Funchal, Madeiras, and, 1897, from Varanger Fjord, Norway. Females with eggs were taken by Mr. Alan Owston from depths of 360 fathoms in the Sagami Sea, Japan.

Hexeptranchidae.

Body elongate, head depressed, caudal long. Eyes lateral, without a nictitating membrane. Nostrils near the end of the snout, not connected with the mouth. Mouth large, inferior, with a labial fold on the lower jaw at the angle. Teeth more or less comb-like, compressed, with slender bases and varying numbers of pointed cusps. Spiracles present, small. One dorsal, not preceded by a spine, behind the ventrals. An anal fin. Gill openings six to seven, in front of the pectorals, margins of covers not free across the isthmus. A spiral valve in the intestine. Many species of several genera are known from the Cretaceous and the Tertiary.

Six gill apertures

pterygoquadrate loosely articulated behind the postorbital process; hyomandibular moderate, elongate

head broad; snout broad . . . . . *Hexanchus* (page 16)

Seven gill apertures

pterygoquadrate loosely articulated to postorbital process; hyomandibular stout

head broad; snout broad . . . . . *Notorhynchus* (page 18)

pterygoquadrate firmly articulated to the postorbital process; hyomandibular slender

head tapering; snout narrow . . . *Heptranchias* (page 21)

Hexanchus.

Hexanchus Rafinesque, 1810, Caratteri, p. 14.

Six gill openings; margin of first gill cover not free across the isthmus. Mouth wide, shorter than the skull, with a rudimentary labial fold on the lower jaw at the angles. Teeth dissimilar, anterior of upper jaw raptorial, lower teeth sectorial, compressed in cusps and bases. Eyes lateral. Spiracles minute. Fins moderate, a notch near the tip of the caudal.

Mediterranean; Atlantic; Eastern Pacific.

Median tooth of lower jaw with or without a medial cusp
  seven cusps, or more on lateral teeth of lower jaw
    inner edge of primary cusp without serrations — *griseus* (page 16)
Median tooth of lower jaw with a small medial cusp
  six cusps on lateral teeth of lower jaw
    inner edge of primary cusp with fine serrations — *corinus* (page 17)

Hexanchus griseus.

Vacca Scilla, 1759, De corp. mar. lap., pl. 1, 27, 28.
Le griset Broussonet, 1780, Mém. Acad. roy., p. 663.
Squalus griseus Bonnaterre, 1788, Ichth., p. 9; Gmelin, 1789, Linné Syst., **1**, p. 1495; Schneider, 1801, Bloch Ichth., p. 129; Risso, 1810, Ichth. Nice, p. 37.
Le squale griset Lacépède, 1798, Poissons, **1**, p. 269.
Squalus vacca Schn., 1801, Bloch Ichth., p. 138.
Hexanchus griseus Rafinesque, 1810, Caratteri, p. 14; 1810, Ind. itt. Sic., p. 47; Müller & Henle, 1841, Plagios., p. 80; Yarrell, 1836, Brit. fishes, **2**, p. 515; Duméril, 1865, Elasm., p. 431, pl. 4, fig. 9–12; Moreau, 1881, Poiss. France, **1**, p. 339; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 19; 1900, ibid., Atlas, pl. 2, fig. 8; Regan, 1905, Ann. mag. nat. hist., ser. 7, **16**, p. 571 (part).
Monopterinus griseus Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 77.
Notidanus griseus Cuvier, 1817, Reg. anim., **2**, p. 128; Agass., 1835, Rech. poiss. foss., pl. E, fig. 2–4; 1838, ibid., Texte, p. 92; 1843, ibid., **3**, p. 216; Bonaparte, 1841, Icon. Fauna Ital., Pesci, fig.–; Couch, 1846, Zool., p. 1337; 1865, Brit. fishes, **1**, p. 21, pl. 4; Bocage & Capello, 1866, Plagios., p. 15; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 397.
Notidanus vacca Cuv., 1817, Reg. anim., **2**, p. 128.
Notidanus monge Risso, 1826, Hist. nat., **3**, Poissons, p. 129.

Body moderately elongate, cavity little more than half, head near one fifth, and tail one third, or more, of the total length. Head large, broad, depressed; snout short, blunt. Nostrils small, near the end of the snout. Eye as long as the snout. Spiracle small, far behind the eye. Six wide gill openings in front of the pectoral. Mouth large, a groove behind its angle reaching half way to the gill aperture, with a labial fold mainly on the lower jaw at the angle. No median tooth on the upper jaws; anterior teeth slender, sharp, without or with basal cusps; anterior two or three of lateral teeth larger with a single cusp at the outer side of the primary, posterior lateral teeth with two or more outer

cusps, hindmost teeth small, with cusps much reduced. Lower jaws with a median tooth which is without or with a median cusp. Agassiz and Duméril have no median cusp in their figures, while Bonaparte and Moreau both figure it as present; in the specimen at hand there is no median lower tooth. First lateral teeth of the lower jaw with seven cusps; primary cusp little longer, without serrations on its inner edge; other cusps and teeth decreasing in size regularly, and cusps increasing in number, one or more, backward.

Dorsal moderate, origin above ends of bases of ventrals, hinder angle acute. Anal smaller, origin below middle of base of dorsal, middle of base below end of that of dorsal, fin acute-angled behind, base about one length distant from origin of subcaudal. Caudal long, one third or more of the total, with modified scales along its upper edge; subcaudal deep anteriorly, separated from the tip by a notch. Pectorals large, as broad as long, subtruncate. Ventrals rather longer than the dorsal, three times as long as broad, hind margin very oblique, outer angle rounded.

Uniform dark brownish.

Described from a 33 inch specimen, taken at Nice, France, which exhibits no traces of symphyseal teeth on the lower jaws. Regan, 1905, identifies this species from Japan, which appears to be correct; he also identifies *H. corinus* from California as the same species, which is not quite so satisfactory.

Hexanchus corinus.

Hexanchus corinus Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, 352; 1883, Bull. 16, U. S. nat. mus., p. 62; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 18.
Notidanus vulgaris Perez, 1886, Estud., p. 8; Philippi, 1887, Ann. Univ. Chile, **71**, p. 22, pl. 41, f. 1.

Head large, broad, depressed; snout short, blunt. Nostrils near the end of the snout. A groove at the angle of the mouth reaching halfway to the gill opening. Eyes large, two thirds the length of the snout. Spiracles small, far behind the eyes. Six gill openings. No median tooth in the upper jaw, anterior teeth slender, sharp, without basal cusps; the anterior of the lateral teeth is larger, has a single cusp at the outer side of its base and is without denticles on its inner edge; backward the number of denticles on the outer side of the base and on the inner edge increase, thus approaching the forms of the teeth of the lower series. Median tooth of lower jaw small, with a median cusp and three cusps at each side the inner of which is the larger; the first of the lateral teeth like the second to the fifth has six cusps, the inner of which is largest and finely serrated and the others decrease gradually in size outward; sixth and seventh of these teeth somewhat smaller.

Dorsal small, little higher than the anal, above the middle of which it terminates. Ventrals small extending behind the origin of the dorsal. Tail long, twice as long as the head, little less than one third of the total, scales on the upper edge of the caudal fin somewhat enlarged.

Uniform dark brown to black, greyish below. Young specimens brown.

Type described, forty-three inches long, from Neah Bay; young from Soquel, Bay of Monterey.

Notorynchus.

Notorynchus Ayres, 1855, Proc. Cal. acad. sci., **1**, p. 73; 1873, p. 77 (reprint).

Resembling Hexanchus, but with seven gill openings. Head broad, depressed, snout broad. Mouth wide, broadly curved in front, with a labial fold from the angle on the lower jaw, and with a deep groove behind the angle. Teeth dissimilar, anterior of the upper raptorial; lower teeth sectorial, compressed in cusps and bases, 6 broad laterals on a lower jaw. Nostrils anterior. Eyes lateral. Spiracle small. Dorsal small, behind the ventrals. Pterygoquadrate loosely articulated to the posterior and lower side of the postorbital process; hyomandibular stout.

Species, *N. primigenius* and *N. serratissimus*, apparently of this genus were described by Agassiz from the Eocene of England.

No median tooth in the upper series
  a median cusp on median lower tooth present or absent
    primary cusp of lower lateral teeth little the larger, denticles of inner edge weak or absent . . . . . *platycephalus* (page 18)

A median tooth in the upper series
  no median cusp on the median lower tooth
    primary cusp of lateral lower teeth little larger, denticulate on the inner edge . . . . . *pectorosus* (page 20)

Notorynchus platycephalus.

Squalus platycephalus Tenore, 1809, Mem. Acad. Pont., **1**, p. 241, 258.
Notidanus sp. Cuvier, 1829, Reg. anim., **2**, p. 390.
Notidanus indicus Agassiz, 1835, Rech. poiss. foss., pl. E, f. 1, Feuilleton, p. 71; 1838, ibid., Texte, p. 92; 1843, ibid., p. 217; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 378 (part).
Heptanchus indicus Müller & Henle, 1841, Plagios., p. 82, pl. 32 (teeth); Schlegel, 1850, Jap. Pisces, p. 303; Duméril, 1865, Elasm., p. 434.
Heptanchus platycephalus Costa, 1854, Chondr., Squal., p. 12, pl. 14, f. 1, 2, 4–6.
Notorynchus maculatus Ayres, 1855, Proc. Cal. acad. sci., **1**, p. 72; 1873, p. 76 (reprint).
Heptanchus maculatus Girard, 1858, Rept. Pacif. R. R., Fish, p. 367.

Heptranchias maculatus GILL, 1861, Ann. N. Y. lyc., **7**, p. 404; JORDAN & GILBERT, 1880, Proc. U. S. nat. mus., **3**, p. 353; 1883, Bull. 16, U. S. nat. mus., p. 62.
Notorhynchus maculatus GILL, 1862, Proc. Acad. nat. sci. Phil., p. 495; 1864, ibid., p. 150; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 17; 1900, ibid., Atlas, pl. 2, f. 7.
Notorhynchus borealis GILL, 1864, Proc. Acad. nat. sci. Phil., p. 150.
Notidanus platycephalus GÜNTH., 1870, Cat. fishes Brit. mus., **8**, p. 398.

Form moderately elongate, depressed anteriorly, compressed backward, much resembling that of *Hexanchus griseus;* body cavity less than half the total in a specimen two feet in length. Head more than five times in the total, broad, depressed, slightly convex on the crown; snout broad, blunt. Eyes medium, half as long as the snout, lateral. Nostrils anterior, near the end of the snout. Spiracles small, far behind the eye. Mouth large, more than twice as wide as long, broadly arched in front. Teeth compressed in cusps and bases; no median tooth in the upper series; at each side of the symphysis there is a pair of small teeth with indistinct basal denticles; at the outer side of these on the six lateral teeth the primary cusp becomes more oblique and the denticles at its base increase in size and number which causes them to resemble more and more the lateral teeth of the lower jaw, though there is more difference in size between the primary cusp and the two to five at its outer side; a median tooth on the lower jaw, more often without a median cusp, is followed by six large laterals on which there are from three to six cusps beside the primary cusp, which latter, as in the upper teeth, is denticulate or serrate on its inner edge; at the angle of the mouth behind the pectinate teeth there are from six to eight rows of small elongate low-crowned teeth remotely resembling those of species of Hybodus or Acrodus. A distinct lower labial fold at the angle of the mouth. As this fold contains the labial cartilages it is evident that the edge of the groove behind the angle is a different structure. The upper extremity of the labial fold encloses a blind sac of considerable size extending toward the eye. Gill openings seven, large, in front of the pectoral.

Pectorals large, nearly as broad as long, hind margin concave. Dorsal small, hardly as large as the ventrals, originating above or little forward of the ends of the ventral bases, hind angles acute. Anal smaller than the dorsal, origin little forward of the end of the latter's base; anal base one and one third times its length forward of the origin of the caudal. Caudal fin very long, on young nearly two and one half times in the total length, subcaudal slightly produced in an angle anteriorly, narrow and separated from the tip by a notch posteriorly; tip pointed; upper edge, in young stages, armed with modified scales.

Back brownish, with scattered small spots and dots of darker; lower surfaces light to whitish.

Mediterranean Sea; Indian Ocean; Eastern North Pacific.

Notorynchus pectorosus.

Heptranchus indicus Macdonald & Barron, 1868, Proc. Zool. soc. Lond., p. 371, pl. 33 (non Agassiz).
Notidanus indicus Hutton, 1872, Cat., p. 79; 1889, Trans. N. Z. inst., p. 276; Ogilby, 1888, Cat., p. 6.
Notidanus (Heptanchus) indicus McCoy, 1880, Zool. Vict., **5**, pl. 43, f. 2.
Heptranchias pectorosus Garman, 1884, Bull. Essex inst., **16**, p. 56; Separate, p. 13.
Notidanus ferox Perez, 1886, Estud., p. 7; Philippi, 1887, Ann. Univ. Chile, **71**, p. 24, pl. 6, f. 2.
Heptanchus indicus Ogilby, 1889, Proc. Linn. soc. N. S. W., ser. 2, **4**, p. 179.
Heptranchias haswelli Ogilby, 1902, Proc. Linn. soc. N. S. W., ser. 2, **22**, p. 62.
Notorhynchus indicus Waite, 1904, Synopsis, p. 5.

Compared with *N. platycephalus* this species is rather more robust; the body appears to be longer and the caudal shorter; the outlines of the head are more regular as seen from above, the snout is more broadly rounded, is less produced between and is less indented at the nostrils. Body elongate, moderately stout, subfusiform, depressed anteriorly and compressed backward; the cavity is nearly half the total length in young, more in adult. Head broad, short, blunt. Eye moderate, length about half the distance from the end of the snout. Spiracle very small, on a vertical a trifle nearer to the first gill opening than to the eye. Mouth large, a thin labial fold extending on the lower jaw less than half way from the angle to the symphysis. Teeth compressed, bases quadrate, cusps narrow; a median tooth in the upper jaw, first lateral tooth with indistinct denticles at the base of the primary cusp, second and third laterals with weak denticles on the inner side and stronger horizontally directed ones on the outer, and the following three or four of the laterals have one or more small cusps on each side of the base of the primary cusp. Lower teeth larger; median tooth small, with four or five denticles at each side; laterals large, denticulate on the inner side of the base of the primary cusp which is hardly larger than the three to five, or more, cusps at its outer side, decreasing in size backward. Several rows of small teeth behind the sixth laterals.

Gill openings seven, in front of the pectorals, widely separated across the chest.

Pectorals nearly as broad as long, posterior margin slightly indented.

Dorsal small, origin above the ends of the bases of the ventrals, base reaching little behind a vertical from the origin of the anal. Anal smaller than the dorsal, origin below the hinder portion of the base of the latter. Caudal shorter than that of *N. platycephalus*; subcaudal with a low angle or lobe anteriorly,

separated from the tip by a decided notch. In young the upper edge of the caudal is protected by three series of enlarged, thickened, and broadened scales. Scales small with a sharp median keel and point, at each side of which there is a smaller shorter one.

Brown with small spots of darker.

Patagonia; New Zealand; Australia.

Heptranchias.

Heptranchias Rafinesque, 1810, Caratteri, p. 13.

Body elongate subfusiform, compressed; head tapering forward; snout narrow, produced. Mouth large, cleft long and wide, narrow in front; angle with a rudimentary labial fold, and a deep groove toward the gill opening. Teeth dissimilar, compressed, laterals each with a large primary cusp denticulate on its inner edge and with four or more smaller cusps, increasing in number backward, behind it; a small symphyseal tooth on the lower jaw. Eye large, lateral. Spiracle small, far behind and above the eye. Dorsal small, behind the ventrals. Caudal long.

Pterygoquadrate closely articulated to the short postorbital process, against the skull; hyomandibular slender, attached to the skull at a lower level than in either Hexanchus or Notorynchus.

One living species known.

Mediterranean; Atlantic; Japan.

Heptranchias perlo.

Plate **56**, fig. 1 (heart); Plate **58**, fig. 1 (intestine).

Le perlon Broussonet, 1780, Mém. Acad. roy., p. 668.
Squalus perlo Bonnaterre, 1788, Ichth., p. 10.
Squalus cinereus Gmelin, 1789, Linné Syst., **1**, p. 1497; Schn., 1801, Bloch Ichth., p. 133; Risso, 1810, Ichth. Nice, p. 24.
Heptranchias cinereus Rafinesque, 1810, Caratteri, p. 13; Gill, 1861, Ann. N. Y. lyc., **7**, p. 494 (name).
Monopterinus cinereus Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 80.
Notidanus cinereus Cuv., 1829, Reg. anim., **2**, p. 390; Bonaparte, 1841, Icon. Fauna Ital., Pesci; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 398.
Heptanchus cinereus Müller & Henle, 1841, Plagios., p. 81, pl. 35, f. 3; Duméril, 1865, Elasm., p. 432; Moreau, 1881, Poiss. France, **1**, p. 339, f. 57.
Heptrancus angio Costa, 1854, Chondr., Squal., p. 5, pl. 13, 14, f. 3.
Heptranchias deani Jord. & Starks, 1901, Proc. Cal. acad. sci., ser. 2, **2**, p. 348; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 595.

Body elongate, slightly compressed; head short, near one fifth of the total length, narrowed forward, little flattened on the crown; snout narrow, produced.

Nostrils small, at the edge of the snout, nearer to the tip than to the mouth. Eyes large, about two thirds as long as the snout, lateral. Spiracle small, on a vertical midway between eye and gill opening. Mouth large, nearly as long as wide, subangular in front, nearly straight on the sides; labial fold rudimentary, on the upper jaw, in the angle; a deep groove from the angle half way to the gill opening. Gill openings seven, wide, close together, in front of the pectoral. Teeth compressed in cusps and bases; upper without a median tooth, about nine (9–10) laterals each with a slender, fang-like, curved, hooked cusp, without or with one or two denticles or serrations on the inner edge of its base, and, posteriorly at least, with one or two denticles on the outer; a few very small teeth behind these laterals (above and below); lower median tooth with a strong cusp at each side of which stands one or a pair of smaller ones; at each side of the median there are five large compressed, quadratic, pectiniform, lateral teeth all of which are denticulate on the inner edge of the primary cusp and bear four to seven (3–9) much shorter cusps on the outer side of the primary, the number increasing backward. Upper jaw (pterygoquadrate) articulated closely and rather firmly to the short postorbital process, against the side of the skull; hyomandibular weaker, more slender, and articulated to the side of the skull at a lower level than in either Hexanchus or Notorynchus. Pectorals nearly as broad as long, hind margins concave, angles rounded, bases closely bound with the muscles of the side. Dorsal small, origin near a vertical from the ends of the bases of the ventrals, hind angle produced, hind margin concave. Anal base about as long as that of the dorsal, origin little forward of that of dorsal base, fin narrow, outer edge very oblique, hind angle produced, length of base more than half the distance from the caudal. Caudal long, less than one third of the total length, tip broadened outward; subcaudal produced in an angle anteriorly, narrow and separated from the tip by a notch posteriorly. Ventrals rather narrow, outer margins very oblique. Scales minute, median keel strong ending in a sharp point, a short less developed keel at each side of the median.

In a young one of ten inches the snout is more depressed and has a deep indentation in front of each nostril; the pectorals are more truncate, the hind angles of the fins less produced, the lower angle of the subcaudal less prominent, and the upper edge of the caudal is armed by three series of large modified scales. The back of this specimen is brown to the middle of the flank, thence the lower surfaces are whitish; the pectorals are dark brown to the wide margin of white across the ends; ventrals and anal are white; dorsal white in forward half and at base to the posterior angle, a large spot of black on upper half; a band of

brownish along the base of the subcaudal, lower margin broadly edged with white; caudal tipped by a large spot of black in front of which is a transverse band of white.

Larger specimens brown on the back shading to white on the lower surfaces.

The specimens at hand, from the Mediterranean Sea and from Japan, belong to the species known to the French by the vernacular name "Perlòn," first described by Broussonet, 1780, afterward given the name "*Squalus perlo*" by Bonnaterre, 1788, a year earlier than the designation *Squalus cinereus* by Gmelin, 1789.

A closely allied species of this genus, very abundant in the formations of the Upper Cretaceous, is that described by Agassiz, 1835, from the English Chalk under the name *Notidanus microdon*, Poissons Fossiles, **3**, pl. 27, f. 1.

Carcharidae.

Body elongate, subfusiform, compressed. Head depressed, tapering. Tail long, compressed, without lateral folds, vertebral axis of caudal nearly horizontal. Nostrils transverse. Mouth large, greatly arched, with labial folds on the lower jaws. Eyes small, without nictitating folds. Spiracles small. Gill openings wide. Teeth subulate, slender, with two rooted bases.

Snout short, mouth somewhat protractile
dorsals, ventrals and anal subequal
caudal pit present above
subcaudal lobe produced . . . . *Carcharias* (page 23)
Snout much produced, mouth greatly protractile
dorsals smaller than ventrals and anal
caudal pit indistinct
subcaudal lobe not produced . . *Scapanorhynchus* (page 28)

Carcharias.

Carcharias Rafinesque, 1810, Caratteri, p. 10.
Triglochis Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 113; Wiegm. arch., p. 396.
Odontaspis Agassiz, 1838, Rech. poiss. foss., Texte, p. 87; 1843, ibid., **3**, p. 287, 306; Müller & Henle, loc. cit., p. 114; 1841, Plagios., p. 73.
Eugomphodus Gill, 1861, Proc. Acad. nat. sci. Phil., p. 60 extra.

Body fusiform; head depressed, tapering; snout short. Nostrils transverse. Eyes without nictitating folds. Mouth large, arched forward. Teeth with awl-shaped lanceolate cusp and two-rooted base, with or without denticles at each side of the cusp. Spiracles small, behind the eyes. Gill openings wide, in

front of the pectorals. Dorsal behind the middle of the trunk, above the space between the pectorals and the ventrals. Second dorsal and anal rather large. Tail compressed, without lateral folds, with a pit at the root of the caudal. Caudals elongate; subcaudal followed by a shallow notch, lobe moderately produced.

Numerous fossil species known from the teeth have been described from the Eocene and later.

Teeth without denticles . . . . . *owstoni* (page 24)

Teeth with one denticle at each side

dorsal in front of the ventrals, first upper tooth smaller than second

rows of teeth $\frac{40-46}{36-40}$ . . . . . *taurus* (page 25)

dorsal partly above the ventrals, first upper tooth equal second

rows of teeth $\frac{32-34}{30-34}$ . . . . . *tricuspidatus* (page 26)

Teeth with two denticles at each side

rows of teeth $\frac{54}{48}$ . . . . . *ferox* (page 27)

Carcharias owstoni, sp. nov.

Body fusiform, robust; head depressed; snout medium, rather pointed, broader than deep. Nostrils transverse, nearer to the mouth than to the end of the snout, anterior valve with a short rounded prominence on its inner half. Mouth large, length nearly two thirds of the width, outline broadly rounded in front; lower labial fold nearly one third of the length of the jaw, upper rudimentary, a mere gash hidden by the lip. Teeth much smaller than those of *C. taurus* on individuals equal in total length: in *C. taurus* the third tooth of the lower jaw of a thirty-eight inch specimen measures a little more than half an inch; in *C. owstoni* this tooth is a little less than three eighths of an inch. Teeth lanceolate slender, two-rooted; first upper tooth little smaller than the second from the middle, fourth upper very small and followed by a vacant space; first lower small; bases without denticles at the sides of the cusps. Eye small, diameter of orbit one third of the preoral length of the snout. Spiracle small, three lengths of the orbit behind the eye, above the angle of the mouth. Gill openings wide, hindmost in front of the pectorals, width equal length of snout from the mouth. Front edge of pectoral broadly curved, nearly twice the length of the hinder edge, inner angle much rounded. Hind margins of all fins concave. Dorsal origin behind the ends of the pectorals, extremity of fin reaching a vertical from the ventrals, little larger than second dorsal, ventrals or anal, which are subequal and somewhat less in size than the pectorals. Ventrals below the

space between the dorsals, end reaching little below the second dorsal. Second dorsal like the first in shape, little shorter, base equal three fourths of its distance from that of the first dorsal, anterior two thirds in front of that of the anal. Anal like the second dorsal, base half its length from the caudal. Depth of caudal two fifths of its length, upper margin curved, vertebral axis little raised, length nearly one third of the total length. Outlines, proportions and markings resembling those of *C. taurus*, front edges of fins more curved, teeth smaller and without the basal denticle, and caudal rather more deep. Caudal peduncle compressed, without lateral keels. Total length 38, snout to abdominal pores 19, snout to first dorsal 14, snout to fifth gill opening $8\frac{1}{2}$, snout to mouth 2, and length of caudal 12 inches.

Greyish or ashy brown, irregularly spotted with rusty brown; lighter on the lower surfaces; borders of fins blackish.

Japan. Alan Owston.

Carcharias taurus.

Plate **6**, fig. 1–3; Plate **41** (brain); Plate **51**, fig. 7 (intestine).

Carcharias taurus Rafinesque, 1810, Caratteri, p. 10, pl. 14, f. 1; Ind., p. 45.
Squalus americanus Mitch., 1815, N. Y. lit. & philos. trans., **1**, p. 483 (non Gmelin, 1789).
Squalus littoralis Mitch., 1818, Amer. mo. mag., **2**, p. 328; Lesueur, 1818, Journ. Acad. nat. sci. Phil., **1**, p. 224.
Squalus macrodous Mitch., 1818, Amer. mo. mag., **2**, p. 328.
Triglochis taurus Müller, & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 114; Wiegm. arch., p. 386; Canestrini, 1872, Ital. pesci, p. 44.
Odontaspis taurus Müller & Henle, 1841, Plagios., p. 73; Duméril, 1865, Elasm., p. 417; Moreau, 1881, Poiss. France, **1**, p. 291; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 58.
Carcharias littoralis De Kay, 1842, N. Y. fish., p. 351; Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 503.
Carcharias griseus Ayres, 1843, Bost. journ. nat. hist., **4**, p. 288, pl. 12, f. 4; Storer, 1867, Mass. fishes, p. 241, pl. 36, f. 1.
Odontaspis americanus Abbott, 1861, Proc. Acad. nat. sci. Phil., p. 400; Duméril, 1865, Elasm., p. 419; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 392 (part).
Eugomphodus griseus Gill, 1861, Proc. Acad. nat. sci. Phil., p. 60 extra.
Eugomphodus littoralis Gill, 1864, Proc. Acad. nat. sci., Phil., p. 260.
Carcharias americanus Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 27.
Odontaspis littoralis Jordan & Gilbert, 1883, ibid., p. 874.
Carcharias (Eugomphodus) littoralis Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 46.

Body robust; head depressed; snout short, tapering, blunted on the end. Nostrils transverse, anterior valve with a somewhat produced lobe near the inner edge. Mouth large, length nearly equal width, arched in the forward portion; lower labial fold nearly one third of the length of the jaw, upper fold rudimentary, hidden. Teeth slender, lanceolate, crooked, in $\frac{40-46}{36-40}$ rows; bases two rooted, with a denticle at each side of the cusp; first upper tooth smaller than the second, fourth small; first lower small. Eye small, length of

orbit about one third of the preoral length, or of the distance from the spiracle, or two fifths of the distance from the nostrils, front edge behind the front of the lower jaws half the length of the orbit. Spiracle small, behind the eyes above the angle of the mouth. Gill openings wide, in front of the pectorals, width of hindmost four fifths of the length of the snout. Pectorals subtriangular, front margins slightly convex. Dorsals, ventrals and anal about equal in size. Origin of first dorsal above the extremity of the pectoral, base equal the height or three fourths of the distance from the second dorsal, end of fin reaching a vertical from the ventrals, hind margin slightly concave. Ventrals below the space between the dorsals, ends reaching little behind the origin of the second dorsal. Second dorsal as large as first, base equal distance from the caudal. Origin of anal, below middle of second dorsal base, length of base nearly twice its distance from the caudal. Depth of caudal less than half the length, which latter is less than one third of the total length; subcaudal lobe produced, rounded on the extremity. Caudal peduncle strong, compressed, with a pit at the root of the caudal, without lateral keels.

Total length 38, snout to abdominal pores 20, snout to dorsal 15, snout to fifth gill opening $8\frac{3}{4}$, snout to mouth 2, and length of caudal $11\frac{1}{4}$ inches.

Ashy gray, lighter below, spotted and blotched with rusty brown.

Specimen described and figured from Buzzard's Bay, Massachusetts.

Atlantic and Mediterranean.

Carcharias tricuspidatus.

Odontaspis americanus Günther, 1870, Cat. fishes Brit. mus., **8**, p. 392 (part).
Carcharias tricuspidatus Day, 1878, Ind. fishes, p. 713, pl. 186, f. 1.
Odontaspis tricuspidatus Day, 1888, Ind. fishes, Suppl., p. 810.

This species is accepted on the authority of Day and Günther. It is evident from the description by the latter of his species *Odontaspis americanus* that it pertains to a distinct form, in which the first tooth of the upper jaw is not smaller than the second and in which the first dorsal is very close to the ventrals. Additional items from Day give his *C. tricuspidatus* a rather broadly rounded snout, place the origins of the ventrals below the hindmost third of the base of the first dorsal and the origin of the anal below the end of the first fourth of the second dorsal, make dorsals, ventrals, and anal about equal in size, give the pectoral a very sharp outer angle. locate the gill openings entirely above the level of the pectorals, put the eyes near one length of the orbit behind the forward ends of the lower jaws, and make the number of rows of teeth $\frac{32-34}{30-34}$. As

in *C. taurus* the long teeth are provided with a small cusp at each side of the base. Day's specimen was 12 feet 3 inches in length; he says the species attains a length of 20 feet.

The localities given are the coasts of Kurrachee and Baluchistan; a specimen from South Australia is mentioned.

Günther mentions others from the Cape seas, and from Tasmania, which are probably of the same species.

Carcharias ferox.

Squalus ferox Risso, 1810, Ichth. Nice, p. 38.
Galeorhinus ferox Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss, Fr., p. 87, pl. 21, f. 2.
Carcharias ferox Risso, 1826, Hist. nat., **3**, Poissons, p. 122.
Odontaspis ferox Agass., 1835, Rech. poiss. foss., pl. G, f. 1; 1838, ibid., Texte, p. 87; Müller & Henle, 1841, Plagios., p. 74, 191; Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 53, f. 2; Duméril, 1865, Elasm., p. 418; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 293; Gerv. & Boul., 1877, Poiss. Fr., **3**, p. 186, pl. 71; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 56; Moreau, 1881, Poiss. France, **1**, p. 293; Perugia, 1881, Pesci Adriatico, p. 54.
Triglochis ferox Müller & Henle, 1838, Charlesworth's mag., **2**, p. 88; Bonaparte, 1839, Mém. Soc. sci. Neuch., **2**, p. 9; Canestrini, 1872, Ital. pesci, p. 43.

Body elongate fusiform; head depressed; snout short, blunted. Nostrils near the mouth; anterior valve, small, triangular. Eye small, above the mid length of the mouth. Mouth large, labial folds on the lower jaw, as in *C. taurus*. Teeth with a strong lanceolate cusp at the base of which on each side there are two denticles, in $\frac{54}{48}$ rows; anterior tooth of each upper jaw small, second and third large, fourth to seventh small, eighth and following large but gradually diminishing in size toward the angles of the mouth; anterior tooth of each lower jaw small, second larger, third largest and followed by similar teeth gradually reduced in size to the small compressed chisel-shaped teeth at the angles. Spiracles small. Gill openings large, width about equal length of snout, hindmost in front of the pectoral. Pectorals moderate, longer than broad, hind margin nearly straight. Dorsal origin above the inner angle of the pectoral about the middle of the trunk, excluding the caudal fin, extremity reaching little behind a vertical from the origin of the ventrals, size greater than that of the second dorsal. Origin of second dorsal behind the ends of the ventrals. Anal smaller than second dorsal and origin nearly below the middle of the latter's base. Caudal less than a third of the total length; subcaudal followed by a shallow notch, lobe somewhat produced.

Back and sides ashy brown; lower surfaces lighter.

Mediterranean and Atlantic.

Scapanorhynchus.

Rhinognathus Davis, 1887, Trans. Roy. Dub. soc., ser. 2, **3**, p. 480.
Scapanorhynchus Woodward, 1889, Cat. foss. fishes Brit. mus., **1**, p. 351.
Mitsukurina Jordan, 1898, Proc. Cal. acad. sci., ser. 3, **1**, p. 200.

Body long, slender; snout elongate, with a much produced rostrum. Mouth large, protrusive, inferior, with labial folds. Teeth subulate, with two rooted bases. Eyes without nictitating folds. Spiracles present. Gill openings five, wide. First dorsal above the space between pectorals and ventrals. Tail long, without lateral folds or caudal pits. Caudal fin long.

This genus dates from the Cretaceous; at present it contains a single known living and four or five fossil species. It is most closely allied to Carcharias as founded by Rafinesque, with which most of the fossil species have at some time been identified, under the name Odontaspis.

Scapanorhynchus owstoni.

Plate **40** (brain); Plate **51**, fig. 1–6 (general anatomy); Plate **56**, fig. 2 (heart).

Mitsukurina owstoni Jordan, 1898, Proc. Cal. acad. sci., ser. 3, **1**, p. 200, pl. 11–12; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 621, pl. 26, 27; Bean, 1905, Proc. U. S. nat. mus., **28**, p. 815, fig.
Scapanorhynchus owstoni Woodward, 1899, Ann. mag. nat. hist., ser. 7, **3**, p. 487; Howes, 1902, Proc. Brit. assoc. adv. sci., p. 626; Dean, 1903, Science, **23**, p. 630; Vaillant, 1904, Comp. rend. Acad. sci. Paris, **138**, p. 1517; Regan, 1906, Proc. Zool. soc. Lond., p. 744; Dofl., 1906, Ostas., p. 256, fig.; Hussakof, 1909, Bull. Amer. mus., **26**, p. 257, fig.
Scapanorhynchus jordani Hussakof, 1909, loc. cit., p. 257, pl. 44.

Body elongate, slender, compressed; head depressed, length to the fifth gill opening nearly one third of the total length; snout very long, pointed, broader than deep, longer than the skull behind it; rostral cartilage simple anteriorly, deeper than wide, posteriorly in three branches, two upper and one lower, as in Carcharias. Nostrils small, oblique, near mouth and eye, anterior valve with a rudimentary lobe above the internal partition of the sac. Eyes small, not as wide as the nostril, pupils vertically elliptical, diameter of orbit two thirds of its distance from the nostril or half the distance from the spiracle. Mouth large, protrusible, somewhat extensible; a labial fold on the lower jaw only, hardly one fourth of its length. Teeth with slender awl-shaped cusps and broader two-rooted bases, in $\frac{48-52}{42-48}$ rows; those in nine or ten rows at the angles of the mouth very small, irregular and without the long cusp; lateral teeth with a denticle on the base at each side of the cusp, anterior teeth larger, without the denticle; anterior tooth of lower series much smaller than the next one to it. A larger space between the third and the fourth teeth of the upper jaw near the

symphysis is curved upward and is without or with teeth that are much smaller than those at either side of it. Spiracle small, less than half the diameter of the eye, behind the orbit, sometimes absent on one side, perhaps on both sides. Gill openings wide, at least three times the width of the orbit, hindmost above the pectoral. All fins rounded on their extremities, longer than wide, and covered by shagreen. Pectorals medium, reaching below the middle of the base of the dorsal. Dorsal origin behind the base of the pectoral, above the hinder half of the fin extremity; end reaching a vertical from the ventrals; fin smaller than the pectoral, rather narrow, in height less than the length of the base. Ventrals larger than the pectorals, equal to the anal, below the space between the dorsals, reaching a vertical from the second dorsal. Second dorsal little longer than the first, base little shorter, end reaching beyond the middle of the anal base; base equal two sevenths of the interdorsal space or two fifths of the distance from the caudal. Anal large, base subtending two fifths of that of the second dorsal, as long as the bases of the ventrals, ending close to the subcaudal. Caudal nearly one third of the total length, deep anteriorly, without a produced subcaudal lobe, subcaudal followed by a shallow notch at the edge of the terminal; vertebral axis of fin very slightly raised. Lateral line distinct, pores small, line nearly straight behind the aural region, descending little on the side of the muscular portion of the tail, resembling that of *Carcharias taurus*. Claspers slender, pointed, reaching one and one-half inches behind the origin of the anal, slit for about six inches, that is from the base of the ventral to within an inch of the end of the organs.

Total length of an adult male 104, snout to abdominal pores 53, snout to first dorsal 36, snout to fifth gill opening 28, snout to skull $10\frac{1}{2}$, length of caudal 34 inches.

Greyish brown, lighter and rust-colored on lower surfaces, darker toward the margins of the fins.

Plate **51** contains a view of a longitudinal section of the skull, a drawing of the branchial cartilages from above and from below, another of the heart and arterial branches, and a section of the spiral intestine as compared with that of *Carcharias taurus*, and on Plate **56**, figure 2 shows the arrangement of the valves in the bulbus.

Sagami Sea, Japan. Specimens, large and small, from Mr. Alan Owston.

Vulpeculidae.

Body fusiform; head short, rounded; tail very long. Mouth arched, with labial folds. Eyes without a nictitating membrane or fold. Spiracles present. Gill openings five, moderate. Pectorals large; first dorsal above the space between the pectorals and the ventrals. A pit at the root of the caudal; vertebral axis raised in the tail; no lateral keels on the caudal peduncle.

Vulpecula.

Vulpecula Valmont, 1768, Dict. hist. nat., **3**, p. 740.
Alopias Rafinesque, 1810, Caratteri, p. 12.
Alopecias Müller & Henle, 1837, Sitzb. Akad. Wiss. Berlin, p. 114, Wiegm. arch., p. 397.

Trunk slightly compressed. Snout subconical, short, blunt. Nostrils transverse. Mouth crescent-shaped. Teeth compressed, triangular, with two-rooted bases and without serrations. Eyes large, pupil vertical. Spiracles small, behind the eyes. Gill openings moderate, hindmost above the pectorals. Pectorals subfalciform. First dorsal large; second dorsal and anal small. Caudal peduncle compressed; fin very long, half or more of the total length; subcaudal lobe produced. Miocene species are assigned to this genus.

Vulpecula marina.

Plate **7**, fig. 1–3; Plate **42**, (brain).

Simia Belon, 1553, Aquat., p. 65.
Vulpecula Salviani, 1554, Aquat., f. 134, pl. 42; Duhamel, 1777, Traité, **3**, sect. 9, p. 302, pl. 21.
Vulpes Rondelet, 1554, Pisc., p. 387; 1558, Hist. poiss., p. 303.
Vulpe marina Gesner, 1558, Aquat., p. 1248; Valent., 1720, Amph. zoot., **2**, p. 82, pl. 65.
Vulpecula marina Aldrov., 1613, Pisc. & Cet., p. 396; Jonst., 1649, Pisc., p. 27, pl. 7, f. 3; Will., 1686, Pisc., p. 54, pl. B6; Valmont, 1768, Dict. hist. nat., **3**, p. 740.
Le Renard marin Perr., 1699, Mém. Acad. sci., **3**, pl. 15, 16; Broussonet, 1780, Mém. Acad. roy., p. 664.
Squalus No. 8, Artedi, 1738, Ichthyologia, Syn., p. 96, Gen., p. 68.
Sea Fox Borlase, 1758, Nat. hist. Cornwall, p. 265; Brookes, 1763, Nat. hist., **3**, Fishes, p. 31; Pennant, 1769, Zool., **3**, p. 86, fig.; Couch, 1867, Brit. fishes, **1**, p. 37, pl. 7.
Long-tailed Shark, Pennant, 1776, Zool., **3**, p. 97, pl. 14.
Squalus vulpinus Bonnaterre, 1788, Ichth., p. 9, pl. 85, f. 349.
Squalus vulpes Gmelin, 1789, Linné Syst., **1**, p. 1496; Schn., 1801, Bloch Ichth., p. 127; Turton, 1807, Fauna, p. 102; Risso, 1810, Ichth. Nice, p. 36; Mitch., 1815, N. Y. lit. & philos. trans., **1**, p. 482.
Le Squale Renard Lacépède, 1798, Poiss., **1**, p. 267.
Alopias macrourus Rafinesque, 1810, Caratteri, p. 12; 1810, Ind. itt. Sic., p. 45.
Squalus (Carcharinus) vulpes Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 94, pl. 14, f. 1.
Carcharias vulpes Cuv., 1817, Reg. anim., **2**, p. 126; Risso, 1826, Hist. nat., **3**, Poissons, p. 120; DeKay, 1842, N. Y. fish., p. 348, pl. 61, f. 199; Guichenot, 1850, Expl. Alg., p. 124; Gay, 1854, Hist. Chile, **2**, p. 363; Storer, 1867, Mass. fishes, p. 245, pl. 36, f. 3.
Fox Shark, Yarrell, 1836, Brit. fishes, **2**, p. 379.
Alopecias vulpes Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 114; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 393; 1910, Südsee fische, **3**, p. 486.

Alopias vulpes Bonaparte, 1841, Icon. Fauna Ital., Pesci; Müller & Henle, 1841, Plagios., p. 74, pl. 35 f. 1 (teeth); Kröyer, 1853, Danm. fiske, **3**, p. 929, 937; Duméril, 1865, Elasm., p. 421; Bocage & Capello, 1866, Plagios., p. 14; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 52; Moreau, 1881, Poiss. France, **1**, p. 287; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 27; Day, 1884, Brit. fishes, **2**, p. 300, pl. 157; 1888, Ind. fishes, Suppl., p. 810; Garman, 1888, Bull. M. C. Z., **17**, p. 80, pl. 12–13; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 45; 1900, ibid., Atlas, pl. 6, fig. 20.
Squalus alopecias Gray, 1854, Gron. syst., p. 7.

Trunk robust, less than half of the total length, little deeper than wide from the nape to the dorsal. Head short, less than one seventh of the total, forehead steep. Snout broader than deep, bluntly rounded at the end. Nostrils small, transverse, nearer to the mouth than to the end of the snout, nearly midway from the eyes; anterior valve with a short lobe near the inner edge. Mouth medium, semicircular; outer labial fold half as long as the mouth, inner half as long as the outer. Teeth small, with a sharp smooth-edged cusp and a broader base, in $\frac{42}{37}$ rows, in a specimen of four feet four inches in length, the third tooth, from the median if present, on the upper jaws little smaller. Eye large, diameter nearly half the length of the snout. Spiracle minute, behind the eye one diameter of the orbit. Gill openings moderate, hindmost two of each side close together at their lower angles and above the pectorals. Front margin of pectorals about one and two thirds times the length of both inner margin and base. Dorsal large, in height equal its entire length, origin above the inner angle of the pectoral, not reaching a vertical from the ventrals. Second dorsal and anal equal, small, origin of latter about one length of its base behind the base of the former. Fins all concave on the hind border. Caudal peduncle strong, deeper than wide; fin more than half of the total length, with a strong subcaudal lobe and with a shallow notch separating the subcaudal from the terminal fin.

Total length 52, snout to abdominal pores 18, snout to caudal $21\frac{1}{2}$, snout to fifth gill opening 7, snout to mouth $1\frac{1}{2}$, and caudal fin $30\frac{1}{2}$ inches.

Dark plumbeous brown on back and flanks to the level of the spiracle where there is a rather abrupt change to the white of the lower surfaces; lower sides of pectorals and a space below the gill openings dark.

Specimen described and figured from Massachusetts Bay.

Isuridae.

Body fusiform; head subconical; caudal peduncle depressed, with lateral folds and caudal pits; vertebral axis of caudal much raised backward from the horizontal. Nostrils oblique, near the mouth but not confluent with it. Mouth large, crescent-shaped, with labial folds. Eyes without nictitating folds.

Spiracle small. Gill openings wide, in front of the pectorals. First dorsal large. Pectorals falciform. Second dorsal and anal small. Many species of fossil forms belonging to this family have been described from the chalk and later formations.

Gills without strainers
- teeth large, triangular, edges serrated
  - without denticles at the base . . . *Carcharodon* (page 32)
- teeth subulate, smooth-edged
  - with or without denticles at the base . . . *Isurus* (page 34)

Gills with strainers
- teeth small, numerous, conical . . . . *Cetorhinus* (page 39)

Carcharodon.

Carcharodon Müller & Henle, 1838, Charlesworth's Mag., **2**, p. 37; 1841, Plag., 70.

Trunk fusiform, massive anteriorly; head conical; caudal peduncle strong, depressed, with lateral keels and with caudal pits. Snout produced. Eye medium, pupil erect; no nictitating folds. Mouth large, crescentic. Teeth large, compressed, serrate, triangular, broader in the upper jaw, on which the third tooth on each side is small. Spiracles small, behind the eye, sometimes absent. Gill openings wide, in front of the pectorals. Pectorals large, falciform. First dorsal large, above the space in front of the ventrals. Second dorsal and anal small. Caudal with vertebral axis much raised backward and with a much produced subcaudal lobe.

Numerous fossil species, Eocene and later, of this genus have been identified by the teeth. Very large teeth have been secured from great depths in recent dredging operations. Fossils from the Eocene, Miocene, and Pliocene have been identified with species now living.

Carcharodon carcharias.

Plate **5**, fig. 5–9.

Lamia Rondelet, 1554, Pisc., p. 390; 1558, Hist. poiss., p. 305; Gesner, 1558, Aquat., p. 204.
Canis carcharias Aldrov., 1613, Pisc. & Cet., p. 383.
Squalus No. 14, Artedi, 1738, Ichthyologia, Gen., p. 70, Syn., p. 98.
Squalus carcharias Linné, 1758, Syst., **1**, p. 235; 1766, Syst., **1**, p. 400; Gmelin, 1789, Linné Syst., p. 1498 (part).
White Shark, Brookes, 1763, Nat. hist., **3**, Fishes, p. 28; Pennant, 1769, Zool., **3**, p. 82; 1776, ibid., p. 93.
Carcharodon verus Agass., 1838, Rech. poiss. foss., **3**, p. 91; 1836, ibid., pl. F, f. 3; Müller & Henle, 1838, Charlesworth's mag., **2**, p. 37.

Carcharodon smithii BONAPARTE, 1839, Mem. Soc. sci. Neuch., **2**, p. 9 extra.
Carcharodon lamia BONAPARTE, 1841, Icon. Fauna Ital., Pesci, pl. 52.
Carcharodon rondeletii MÜLLER & HENLE, 1841, Plagios. p. 70; DUMÉRIL, 1865, Elasm., p. 411; BOCAGE & CAPELLO, 1866, Plagios., p. 13; GÜNTH., 1870, Cat. fishes Brit. mus., **8**, p. 392; DODERLEIN, 1881, Man. ittiol. Medit., **2**, p. 66; JORDAN & GILBERT, 1883, Bull. 16, U. S. nat. mus., p. 30; Ogilby, 1888, Cat. p. 2; GÜNTHER, 1910, Südsee fische, **3**, 485.
Carcharias atwoodi STORER, 1848, Proc. Bost. soc. nat. hist., **3**, p. 72; 1867, Mass. fishes, p. 246, pl. 36, f. 4.
Carcharodon capensis A. SMITH, 1849, Afr. Pisces, pl. 4.
Carcharodon carcharias JORDAN & GILBERT, 1883, Bull. 16, U. S. nat. mus., p. 875; STEVENSON, 1884, Trans. Vassar Bros. inst., **2**, p. 83, pl. 1, 2; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 50; 1905, Bull. U. S. fish. comm., **23**, p. 44.

Head little more than one fourth, body cavity more than one half, and caudal less than one fifth of the total length. Snout subconical, little wider than deep at the nostrils, blunted at the end. Nostrils small, far apart, nearer to the mouth and the eye than to the end of the snout, with a very small projection on the anterior valve. Eye above the front of the mouth, pupil erect. Mouth wide, with labial folds. Teeth large, triangular, serrated, in $\frac{26}{24}$ rows; upper broader, third tooth on each side smaller, Pl. 5, fig. 6; lower narrower and with edges more concave in the cusp. Spiracle minute, behind the eye in front of midway to the gill opening. Gill openings very wide, space between first and second four times as wide as that between fourth and fifth, hindmost in front of the pectoral. Pectorals falciform, front margin nearly twice the length of base and inner edge. First dorsal moderate, entirely in front of the middle of the total length, origin behind the bases of the pectorals, little longer than high. Second dorsal very small, base entirely forward of that of the anal. Anal small, similar to second dorsal, origin behind a vertical from the base of that fin. Ventrals rather small, below the middle of the interdorsal space. Caudal peduncle broader than deep, a pit above and a less developed one below. Caudal fins broad, supracaudal raised and longer than the subcaudal, subcaudal lobe much produced making the depth of the caudal greater than its length. Scales small, tricarinate.

Total length $86\frac{1}{2}$, snout to caudal pit $69\frac{1}{2}$, snout to ventrals 47, snout to first dorsal 32, snout to fifth gill opening $23\frac{1}{2}$, snout to first gill opening 17, snout to mouth or to eye $4\frac{1}{2}$, and length of caudal $16\frac{1}{2}$ inches. Specimen taken in Massachusetts Bay. Said to reach a length of forty feet or more.

Back slaty brown, shading to white on the sides and beneath. A black spot in the axil of the pectoral is followed by white on body and fin. Fins darkening backward, except ventrals, which are olive on the front portions and elsewhere white.

Seas of the temperate and the torrid zones.

Isurus.

Isurus Rafinesque, 1810, Caratteri, p. 12.
Lamna Cuv., 1817, Reg. anim., **2**, p. 126.
Lamna and *Oxyrhina* Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 1141.
Isuropsis, *Isurus*, and *Lamna* Gill, 1861, Ann. N. Y. lyc., 7, p. 398.

Snout produced, pointed. Teeth awl-shaped, with two-rooted base and with or without denticles on the base. Spiracles behind the eye, sometimes absent. Gill openings wide, in front of the pectoral. Pectorals large, subfalciform. First dorsal large. Caudal with a much produced lower lobe. With two subgenera, Isurus and Lamna. Many Cretaceous and Tertiary species.

Teeth with denticles at each side of the base in adults . *Lamna* (page 34)
dorsal origin above the ends of the pectorals
second dorsal above the anal . . . . *nasus* (page 34)
Teeth without denticles . . . . . *Isurus* (page 36)
dorsal origin above the pectorals
second dorsal above the anal
teeth small . . . . . *punctatus* (page 36)
second dorsal in front of the anal
teeth medium . . . . . *tigris* (page 36)
dorsal origin near a vertical from end of pectoral base
second dorsal origin in front of that of anal . *oxyrhynchus* (page 37)
dorsal origin near a vertical from the ends of pectorals
second dorsal nearly in front of the anal
teeth large, in about $\frac{24}{22}$ rows . . . *glaucus* (page 38)
dorsal origin behind the pectoral about one length
second dorsal in front of the anal
teeth in $\frac{22}{28}$ rows "either side" . . . *güntheri* (page 39)

Isurus nasus.

Porbeagle Borlase, 1758, Nat. hist. Cornwall, p. 265, pl. 26, f. 4; Pennant, 1769, Zool., **3**, p. 92; 1776, Zool., **3**, p. 117; Goodenough, 1797, Trans. Linn. soc., **3**, p. 80, pl. 15; Yarrell, 1836, Brit. fishes, **2**, p. 384; Couch, 1867, Brit. fishes, **1**, p. 41, pl. 8.
Squalus glaucus Gunner, 1770, Norsk. vid. selsk. skr., **4**, p. 1 (non Linné); Ascanius, 1777, Icon., pl. 31.
Beaumaris Shark, Pennant, 1776, Brit. zool., **3**, p. 104, pl. 17.
Haaebrand Ascanius, 1777, Icon., pl. 31.
Le Nez Broussonet, 1780, Mém. Acad. roy., p. 667.
Touille boeuf, Taupe de Mér, Duhamel, 1782, Traité, **4**, p. 298, pl. 20, f. 4 (lacks anal fin).
Squalus nasus Bonnaterre, 1788, Ichth., p. 10, pl. 85, f. 350; Walbaum, 1792, Artedi, p. 517.
Squalus cornubicus Gmelin, 1789, Linné Syst., **1**, p. 1497; Schn., 1801, Bloch Ichth., p. 132; Turton, 1807, Fauna, p. 113; Donovan, 1807, Br. fish., **5**, pl. 108; Neill, 1811, Mem. Wern. soc., **1**, p. 549; Jenyns, 1835, Man., p. 500; Wright, Fries, & Ekström, 1836, Skand. fisk., p. 135, pl. 30.

Squalus pennanti WALBAUM, 1792, Artedi, p. 517.
Le Squale long-nez LACÉPÈDE, 1798, Poissons, **1**, p. 216, pl. 2, f. 3.
Squalus monensis SHAW, 1804, Zool., **5**, pt. 2, p. 350; CUV., 1817, Reg. anim., **2**, p. 127.
Squalus selanonus LEACH, 1814, Mem. Wern. soc., **2**, p. 64, pl. 2, f. 2.
Carcharinus cornubicus BLAINV., 1816, Bull. Soc. philom., p. 121.
Lamna cornubica CUV., 1817, Reg. anim., **2**, p. 127; FLEMING, 1828, Brit. anim., p. 168; PARNELL, 1838, Mem. Wern. soc., **7**, p. 413; MÜLLER & HENLE, 1841, Plagios., p. 67; BONAPARTE, 1841, Icon. Fauna Ital., Pesci; AGASS., 1843, Rech. poiss. foss., **3**, p. 287, pl. G, f. 3; SCHLEGEL, 1850, Jap. Pisces, p. 304; THOMPSON, 1856, Nat. hist. Ireland, **4**, p. 251; KRÖYER, 1853, Danm. fiske, **3**, p. 852; NILSSON, 1855, Fisk. Skand., **4**, p. 718; DUMÉRIL, 1865, Elasm., p. 405; BOCAGE & CAPELLO, 1866, Plagios., p. 12; GÜNTHER, 1870, Cat. fishes Brit. mus., **8**, p. 389; GERV. & BOUL., 1876, Poiss. Fr., **3**, p. 180, pl. 168; MOREAU, 1881, Poiss, France, **1**, p. 296; DODERLEIN, 1881, Man. ittiol. Medit., **2**, p. 60; DAY, 1884, Brit. fishes, **2**, p. 297, pl. 156; JENSEN, 1907, Dan. fiske, p. 296, pl. 27, f. 2.
Selanonius walkeri FLEMING, 1828, Brit anim., p. 169.
Squalus (Carcharinus) lamia BLAIN., 1830, Poiss. Fr., p. 88.
Squalus (Carcharinus) cornubicus BLAIN., 1830, Poiss. Fr., p. 96, pl. 14, f. 2.
Isurus cornubicus GRAY, 1851, Chondropterygii, p. 58.

Body subfusiform, more massive anteriorly, slender, depressed, and with a prominent keel at each side in the caudal peduncle, from the second dorsal backward. Snout conical, longer than the mouth. Eye large, above the middle of the mouth. Nostrils small, in the hindmost third of the snout. Mouth large, much arched in front. Teeth with broad two-rooted base and slender lanceolate cusp at the base of each side of which in the larger specimens there is a sharp denticle, in $\frac{28}{26}$ rows, third upper tooth at each side of the symphysis much smaller. Outlines of the teeth as seen from the sides less waved than those of *I. punctatus* and other species; the teeth are more compressed and the edges are sharper. Spiracles minute, nearly midway from the eye to the gill opening, or absent. Gill openings large, width rather more than the length of the snout. Pectorals subfalciform, pointed, outer margin about four times the length of the inner. Origin of the first dorsal above the ends of the bases of the pectorals, length of base about equal to height of fin, upper angle sharp, end far from the origins of the ventrals, basal length nearly two fifths of the distance from the second dorsal. Ventrals midway between the dorsals. Second dorsal very small, above the anal, which latter it nearly equals in size. Vertebral axis of the caudal much raised from the horizontal; a notch behind the subcaudal fin; subcaudal lobe much produced; lateral keels prominent. Specimens are said to reach a length of more than ten feet.

Greyish brown above; white below; young with white edges on some of the fins.

Jensen, 1907, publishes a fair representation of this species and of its dentition.

Reported from the British Isles, the Mediterranean, the Western Atlantic, and from Japan.

Isurus punctatus.

Plate 6, fig. 4–6; Plate 56, fig. 5, (heart); Plate 58, fig. 3, (intestine); Plate 62, 63, (skeleton).

Lamna punctata Storer, 1839, Report fishes, p. 185, pl. 3, f. 2; Boston journ. nat. hist., **2**, p. 534; 1846, Mem. Amer. acad., new ser., **2**, p. 504; 1867, Mass. fishes, p. 249, pl. 37, f. 1 (non syn.).
Oxyrhina dekayi Gill, 1861, Proc. Acad. nat. sci. Phila., p. 60 extra.
Isuropsis glaucus Gill, 1864, Proc. Acad. nat. sci., Phil., p. 260.
Oxyrhina punctata Duméril, 1865, Elasm., p. 409.
Lamna cornubica Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 30.
Isurus punctatus Garman, 1888, Bull. M. C. Z., **17**, p. 79, pl. 1.

Form similar to that of *I. nasus*. Body subfusiform, massive in the anterior half, depressed and with lateral keels in the caudal peduncle. Head slightly flattened on the crown, snout long, pointed, conical. Nostrils small, far apart, near the mouth and the eyes. Eye large, orbit round, pupil erect; no nictitating membrane. Mouth large, crescentic; upper labial fold less than half as long as the jaw, lower much the shorter. Teeth rather small, in $\frac{26}{24}$ rows, with slender sharp-edged cusp and broad two-rooted base, without denticles at the sides, lower teeth more erect. Spiracles minute, above the angle of the mouth. Width of gill openings less than length of snout. Pectorals subfalciform, width not more than half the length, angles rounded, outer extremity reaching beyond the base of the dorsal. Dorsal in front of the mid length, origin slightly behind the base of the pectoral, greatest length little more than the height, upper angle rounded. Second dorsal very small, above the anal. Anal little larger than second dorsal and origin very little farther forward. Ventrals below the middle of the space between the dorsals, caudal about one fifth of the total length, vertebral axis much raised backward. Spiral intestine with about 38 turns.

Dark bluish brown on back and sides, abruptly changing to white on the lower surfaces; dorsals, pectorals, and caudal tipped with black. In the axil on the base of the pectoral there is a black area, followed on the fin and the body by a white space as in *Carcharodon carcharias*. A large spot of black below the outer half of the pectoral.

Abundant off the eastern coast of the United States.

Isurus tigris.

Lamna punctata DeKay, 1842, N. Y. fish., p. 352, pl. 63, f. 206 (non *L. punctata* Storer, 1839).
Isuropsis dekayi Gill, 1861, Ann. N. Y. lyc., **7**, p. 409 (non *Oxyrhina dekayi* Gill, 1861); Poey, 1868, Repertorio, **2**, p. 446.
Carcharias tigris Atwood, 1869, Proc. Boston soc. nat. hist., **12**, p. 268.
Isurus glaucus Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 28.
Isurus dekayi Jordan & Gilbert, ibid., p. 874; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 48; 1900, ibid., Atlas, pl. 6, f. 21.

Head to the fifth gill opening nearly one fourth of the total length; body moderately robust; snout subconical, elongate, sharp. Teeth smaller than those of *I. oxyrhynchus*, similarly without basal denticles, with a sharp slender curved cusp, and with the third tooth at each side of the middle of the mouth on the upper jaws much smaller than the second or the fourth. Pectorals subfalciform, outer portion rather narrow, front margin about twice as long as the base and the inner margin together, inner angle rounded. First dorsal a short distance behind the pectorals, front margin straighter and upper angle sharper than in *I. glaucus*. Second dorsal little in advance of the anal and nearly its equal in size. Ventrals about midway from the bases of the pectorals to the caudal, nearer to the dorsal than to the anal. Extremities of the caudal sharp, front margin of the subcaudal lobe about two thirds of the length of that of the supracaudal. Attains a length of more than ten feet.

Bluish to ashy brown; white on the lower surfaces, color sharply defined on the level of the caudal keels.

This species is distinguished from *I. punctatus* by a sharper snout, narrower and longer pectorals, narrower dorsal and caudal, and by the positions of the dorsals. A higher more erect and sharper dorsal, placed farther back, and narrower and more pointed pectorals separate it from *I. glaucus*. The backward insertion of the dorsal, and smaller teeth, and the forward position of the second dorsal as compared with the anal prevent confusion with *I. oxyrhynchus*. Non-acquisition of denticles on the teeth of adults and the rearward insertion of the first dorsal limit its affinities with *I. nasus*.

Gulf of Mexico to New York; West Indies.

Isurus oxyrhynchus.

Cane di mare di Messina Spallanzani, 1793, Viagg. alle due Sicil., **4**, p. 325.
Isurus oxyrinchus Rafinesque, 1810, Carratteri, p. 12, pl. 13, f. 1; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 29; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 48.
Isurus spallanzani Rafinesque, 1810, Ind. itt. Sic., p. 45, 60; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 874.
Lamna oxyrhina Owen, 1840, Odont., p. 28, pl. 3, f. 1, pl. 5, f. 1.
Oxyrhina gomphodon, Müller & Henle, 1841, Plagios., p. 68, pl. 28; Bocage & Capello, 1866, Plagios., p. 13.
Oxyrhina spallanzanii Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 53; Agass., 1843, Rech. poiss. foss., **3**, p. 276, pl. G, f. 2; Duméril, 1865, Elasm., p. 408; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 62, synon. part; Moreau, 1881, Poiss. France, **1**, p. 298.
Lamna spallanzanii Günth., 1870, Cat. fishes Brit. mus., **8**, p. 390 (excl. synon).

Outlines similar to those of *I. nasus* or *I. punctatus*; body apparently a trifle more slender than in either. Snout long, pointed, subconical, slightly angular in a cross section. Crown depressed in a low arch transversely. Nos-

trils much nearer to the mouth than to the end of the snout. Eye little in advance of the mid length of the mouth. Mouth large, length equal to preoral distance, angles midway from end of snout to pectorals. Teeth large, in $\frac{26}{24-26}$ rows; cusp lanceolate, strong, curved, with sharp edges, without basal denticles; base two-rooted, rather swollen; third tooth of the upper jaws much smaller than the second or the fourth. Eye comparatively small. Spiracles minute, above and somewhat behind the angle of the mouth. Width of gill openings nearly equal to preoral length of snout. Pectorals large, falciform, base and inner edge together equal to about half of outer edge, outer angle sharp, hind margin deeply concave. Origin of dorsal nearly above the end of the pectoral base; dorsal base nearly one third of the interdorsal space, and about equal to the distance from the origins of the ventrals. Second dorsal and anal subequal, origin of anal a short distance behind that of the second dorsal. Caudal large, lunate, subcaudal lobe greatly developed, blunted.

Bluish grey to brown; white beneath.

Mediterranean and Atlantic.

Isurus glaucus.

Oxyrhina glauca Müller & Henle, 1841, Plagios., p. 69, pl. 29; Schlegel, 1850, Jap. Pisces, p. 302; Duméril, 1865, Elasm., p. 409.
Isuropsis glaucus Gill, 1861, Ann. N. Y. lyc., **7**, p. 398, 409 (name); Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 623.
Lamna glauca Günth., 1870, Cat. fishes Brit. mus., **8**, p. 391; 1910, Südsee fische, **3**, p. 484.
Lamna spallanzanii Day, 1878, Ind. fishes, p. 722, pl. 186, f. 2.

Head nearly one fourth of the total length; crown depressed in a low arch transversely; snout longer than the mouth, subconical. Nostrils small, width two fifths of the length of the orbit, nearer to the eye than to the end of the snout. Length of mouth equal its width; sides straight to the broadly arched anterior portion; labial folds nearly half the length of each jaw, at the inner edge of the lips. Teeth long slender, unequal, in $\frac{24}{22}$ rows, sharp-edged, outlines sinuate, without denticles at the sides of the base. Spiracles minute, above the angle of the mouth. Outer edge of pectoral about four times as long as the inner, angles rounded, hind margin slightly concave. Origin of the first dorsal near a vertical from the inner extremity of the pectoral, front margin strongly curved; base about half its length farther back than that of the pectoral, length little greater than the height of the fin, more than one third of its distance from the second dorsal; hind angle rather short but sharp; greater part of hind margin vertical. Second dorsal very small, base almost entirely in front of that of the anal. Anal

little, if any, larger than second dorsal. Ventrals below the middle of the space between the dorsals. The width of the gill openings of the specimen described equals the length of the snout; the hindmost opening is in front of the pectoral. The teeth are larger than in a specimen of *I. punctatus* of the same length.

Back dark bluish or blackish brown, the dark color being distinctly limited on the level of the caudal carinae from the white of the lower surfaces.

Idzu Sea, Japan. Alan Owston.

Isurus güntheri.

Lamna güntheri Murray, 1884, Ann. mag. nat. hist., ser. 5, **13**, p. 349; Day, 1888, Ind. fishes, Suppl., p. 810.

Snout much produced, triangular. Nostrils nearer to the eye than to the end of the snout. Teeth "$\frac{22}{28}$ on either side" (Day), with smooth sharp edges, without basal cusps. Anterior teeth of the lower jaw largest; third tooth at each side of the symphysis on the upper jaws smaller than the rest. First dorsal nearer to the pectorals than to the ventrals, a little farther behind the base of the former than in *I. spallanzanii*, that is, about its own length behind the bases of the pectorals. Anal about its own length behind the second dorsal.

This species differs in the large numbers of rows of teeth from the other known Isuri.

Type, from Kurrachee, India, 86 inches in total length, caudal 18, and pectorals 16 inches.

Cetorhinus.

Cetorhinus Blainv., 1816, Bull. Soc. philom., p. 121.
Selache Cuv., 1817, Reg. anim., **2**, p. 129.
Polyprosopus Couch, 1867, Brit. fishes, **1**, p. 67.

Body elongate, subfusiform. Snout produced, subconical. Nostrils near the mouth. No nictitating folds. Mouth large. Teeth conical, small, numerous. Spiracles small, behind the eye. Gill openings five, very wide, hindmost in front of the pectorals. Gills with strainers. Pectorals and first dorsal large, latter above the space between pectorals and ventrals; second dorsal and anal small. Tail with a keel at each side and with caudal pits. Caudal large, vertebral axis raised, subcaudal lobe much produced. One living species known.

Fossil forms have been described from the Chalk and later.

Cetorhinus maximus.

Squalus maximus Gunner, 1765, Trondj. sels. selskr., **3**, p. 33, tab. 2; Linné, 1766, Syst., **1**, p. 400; Gunner, 1770, Norsk. vid. selsk. skr., **4**, p. 14, tab. 3; Bonnaterre, 1788, Ichth., p. 10; Schn., 1801, Bloch Ichth., p. 134; Blainville, 1810, Jour. de phys., p. 1 extra; Mitch., 1815, N. Y. lit. & philos. trans., **1**, p. 486; Fleming, 1828, Brit. anim., p. 164.

Basking shark PENNANT, 1769, Zool., **3**, p. 78; 1776, ibid., **3**, p. 101, pl. 13; HOME, 1810, Philos. trans., p. 206; LOW, 1813, Fauna Orcad., p. 173; YARRELL, 1836, Brit. fishes, **2**, p. 396; COUCH, 1867, Brit. fishes, **1**, p. 60, pl. 14.

Le tres-grand BROUSSONET, 1780, Mém. Acad. roy., p. 669; DAUBENTON, 1787, Encycl. meth., **3**, p. 96; LACÉPÈDE, 1798, Poissons, **1**, p. 209.

Squalus pelegrinus BLAINV., 1810, Journ. de phys. p. 18, pl. 2, f. 2; Ann. mus., **18**, p. 88, pl. 6.

Cetorhinus gunneri BLAINV., 1816, Bull. Soc. philom., p. 121.

Cetorhinus homianus BLAINV., 1810, Journ. de phys., p. 19, extra, pl. 2, f. 1, 1816, Bull. Soc. philom., p. 121.

Cetorhinus shavianus BLAINV., 1816, Bull. Soc. philom., p. 121.

Selache maxima CUV., 1817, Reg. anim., **2**, p. 129; F. FABER, 1829, Fische Islands, p. 20; RICHARDSON, 1836, Faun. Bor. Amer., **3**, p. 29; PARNELL, 1838, Mem. Wern. soc., **7**, p. 418; MÜLLER & HENLE, 1841, Plagios., p. 71; NILSSON, 1855, Fisk. Skand.; THOMPSON, 1856, Nat. hist. Ireland, **4**, p. 253; DUMÉRIL, 1865, Elasm., p. 413; BOCAGE & CAPELLO, 1866, Plagios., p. 14; CAPELLO, 1869, Jor. Acad. sci. Lisboa, **7**, p. 140; GÜNTH., 1870, Cat. fishes Brit. mus., **8**, p. 394; PAVESI, 1874, Ann. Mus. civ. Genoa, **6**, p. 36; 1878, ibid., **12**, pl. fig.; LÜTKEN, 1880, Vid. medd. nat. forh., p. 62; DODERLEIN, 1881, Man. ittiol. Medit., **2**, p. 70; DAY, 1884, Brit. fishes, **2**, p. 303, pl. 158, f. 1.

Squalus isodus MACRI, 1819, Atti Accad. sci. Napoli, **1**, p. 55, pl. 1, f. 1, pl. 2.

Squalus rostratus MACRI, 1819, ibid., p. 76, pl. 1, fig. 2.

Squalus elephas LE SUEUR, 1822, Journ. Acad. nat. sci. Phil., **2**, p. 350, pl.; STORER, 1839, Report fishes, p. 407.

Squalus rashleighanus COUCH, 1825, Trans. Linn. soc., **14**, p. 91; 1838, Cornish Fauna, **1**, p. 51.

Squalus cetaceus GRAY, 1854, Gron. syst., p. 6.

Polyprosopus rashleighanus GILL, 1861, Ann. N. Y. lyc., **7**, p. 398; COUCH, 1867, Brit. fishes, **1**, p. 67, pl. 14, f. 1.

Polyprosopus macer COUCH, 1867, Brit. fishes, **1**, p. 68, fig.

Cetorhinus blainvillii CAPELLO, 1869, Jor. Acad. sci. Lisboa, **7**, p. 133.

Cetorhinus rostratus CORNISH, 1870, Zool., **2**, no. 59.

Selache rostrata PAVESI, 1874, Ann. Mus. civ. Genoa, **6**, p. 36, pl. 1–3.

Cetorhinus maximus GERVAIS, 1876, C. R. Acad. sci. Paris, **82**, pl. 138; Journ. zool., **5**; JORDAN & GILBERT, 1883, Bull. 16, U. S. nat. mus., p. 31; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 51; 1900, ibid., Atlas, pl. 7, f. 23.

Outlines bearing much resemblance to those of Isurus. Body subfusiform, massive forward, more slender behind the dorsal fin. Snout subconical, of moderate length. Eyes small, without a nictitating membrane, above the forward end of the mouth. Spiracle small, behind the eye, above the hinder part of the mouth. Nostrils small, near the sides of the snout and near the mouth. Mouth very large, curved forward. Teeth small, subconical, very numerous, a half dozen or more of the series in function at once, smooth edged. Gill openings in front of the pectoral, extending nearly around the neck, the anterior pair being narrowly separated on the back and on the throat. Gill arches bearing strainers, apparently modified teeth or scales, in some respects resembling whalebone, whence the name "Bone Shark." Pectorals medium, pointed, front edge about twice the length of the base and the inner edge together, fin reaching below the middle of the dorsal. Dorsal above the space between the pectorals and the ventrals, nearer to the latter, origin a short distance behind the inner extremities of the former, height less than length of base, fin angled above; hinder angle sharp, not reaching a vertical from the ventrals. Ventrals rather small, below the space between the dorsals, nearer

the first dorsal. Second dorsal and anal small, nearly equal, anal base the farther back, origin below the hind part of the second dorsal. Caudal peduncle depressed, with lateral folds and with pits at the root of the caudal fin. Caudal fin large, vertebral axis much raised backward, a notch behind the subcaudal, subcaudal lobe produced, sharp. Reaches a length of thirty-five feet or more.

Back greyish brown; lower surfaces white.

Arctic Seas to the temperate regions.

Rhincodontidae.

This family contains a species of large shark, the affinities of which place it near Cetorhinus. It approaches that genus in its enormous size, large mouth, small eyes, small spiracles, small teeth, large pectorals, in the sizes and proportions of dorsals and anal, in the erected caudal, the caudal pit and the development of the subcaudal lobe. It has nasoral grooves, and has keels on the body as on some of the Orectolobidae, but it differs from them in lacking nasal cirri, in size, in the disproportions of pectorals and dorsals, in the erected supracaudal, the lobed subcaudal, and the lateral keels of the caudal pedicel.

Rhincodon.

Rhincodon A. Smith, 1829, Zool. journ., **4**, p. 443.
Rhineodon Müller & Henle, 1837, Wiegm. archiv., **1**, p. 84; Swains., 1839, Class, **2**, p. 314; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 626.
Rineodon Müller & Henle, 1838, Charlesworth's mag., **2**, p. 37; Swains, 1838, Class., **1**, p. 142.
Rhinodon Müller & Henle, 1841, Plagios., p. 77; A. Smith, 1849, Afr. Pisces, pl. 26; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 396.
Micristodus Gill, 1865, Proc. Acad. nat. sci. Phil., p. 177.

Subfusiform. Head depressed; snout broad, blunt. Eyes small, lateral, near the angle of the mouth, without a nictitating membrane, lower lid without a fold. Spiracles small, lateral. Nostrils anterior, grooved to the mouth, without cirri. Mouth large, anterior, with labial folds on both jaws. Teeth very small, very numerous, subconical, curved. Gill openings wide, hindmost narrower, two above the pectoral. Pectorals large, falciform. Two dorsals, without spines, with produced angles; anterior near the middle of total length, much the largest, separated by more than the length of its base from the second dorsal. Anal very small. Tail with a pit at the origin of the supracaudal, which latter is erected as in Isuridae; subcaudal with a well developed lobe; pedicel with a keel at each side.

Pacific and Indian Oceans.

Rhincodon typus.

Rhincodon typus A. Smith, 1829, Zool. journ., **4**, p. 443.
Rhinodon typicus Müller & Henle, 1841, Plagios., p. 77, pl. 35, f. 2; A. Smith, 1849, Afr. Pisces, pl. 26; Duméril, 1865, Elasm., p. 428; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 396; Haly, 1883, Ann. mag. nat. hist., ser. 5, **12**, p. 48; Thurston, 1884, Bull. 1 Madras mus., pl. 3A; Regan, 1908, Proc. Zool. soc. Lond., p. 353; Günther, 1910, Südsee fische, **3**, p. 486.
Micristodus punctatus Gill, 1865, Proc. Acad. nat. sci. Phil., p. 177; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 32; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 52.
Rhinodon pentelineatus Kishinouye, 1901, Zool. anz., p. 694.
Rhineodon typicus Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 626.

A very large species, attaining a length of more than 30 feet, with feeding habits resembling those of the basking shark, Cetorhinus. Head depressed; snout broad, subtruncate; body cavity more than half the total length. Eye small, lateral, near the angle of the mouth, lower lid without a fold. Spiracle small, behind the eye. Nostrils at the end of the snout, near the lip; anterior valves widely separated, reaching the teeth, without cirri. Mouth wide, anterior, transverse, with labial folds on both jaws; upper fold elongate, lower short. No longitudinal symphyseal groove. Teeth very small, subconical, sharp, numerous. In the type the teeth were said to be 12 to 15 in a longitudinal row and about 250 in a transverse series; Kishinouye, 1901, counted on his specimen 16 to 30 in a longitudinal row and 300 or more in a transverse series. Gill apertures very wide, hindmost narrower, hindmost two above the pectoral. Gill arches with long rakers serving as strainers for small prey. A pair of keels or ridges on each flank beginning above the gill apertures, the upper continued to the space between the dorsals, the lower meeting the keel at the side of the tail. Pectorals large, broad, falciform with sharp angles and concave hind margin. Dorsals unequal, hinder angles produced; anterior dorsal large, posterior margin deeply concave, nearly in the mid total length. Second dorsal small, distant from first more than length of base of latter. Anal smaller than second dorsal and originating below the hinder half of its base. Ventrals small, origin below hinder portion of first dorsal base. Tail with keel at each side of pedicel; with notch at origin of fin. Caudal large, vertebral section raised, subcaudal lobe well developed.

Purplish to reddish brown profusely sprinkled with small spots and streaks of white; lower surfaces light reddish brown.

Cape Good Hope; Japan; Knights Key, Fla.

Orectolobidae.

Body short and subcylindrical to moderate and depressed. Head narrow with snout of medium length to broad with a very short snout. Tail long and slender with short caudals to rather short with long caudals. Nostrils with a nasoral groove and with a cirrus on the anterior nasal valve. Mouth transverse, with labial folds around the angle on both jaws. Teeth compressed with or without lateral cusps at each side of the median. Eyes small, without nictitating membrane. Spiracle minute and behind the eye to large and more or less below it. Gill openings small to medium, hindmost two or three above the pectorals. Fins short and broad, except the caudal which most often is narrow and not lobed. No fin spines; no pits at the root of the caudal.

First dorsal above the ventrals
- second dorsal in front of the anal
  - tail long, caudal short; no dermal lobes
    - body short; anal close to the caudal — *Hemiscyllium* (page 44)
  - tail long, caudal long
    - body short; mouth inferior; anal close to caudal — *Brachaelurus* (page 47)
    - anal at a short distance from caudal — *Heteroscyllium* (page 48)
  - tail short, caudal short; dermal lobes present
    - body long; mouth nearly anterior — *Orectolobus* (page 49)
    - dermal lobes numerous under the lower jaws — *Eucrossorhinus* (page 53)
  - tail medium; caudal medium; teeth tricuspid;
    - body medium; fins rounded — *Ginglymostoma* (page 54)
  - tail long; caudal long; teeth multicuspid;
    - body medium; fins angulate — *Nebrodes* (page 56)

First dorsal forward of the ventrals
- second dorsal in front of the anal
  - tail very long; caudal very long; fins rounded
    - body short — *Stegostoma* (page 59)

First dorsal behind the ventrals; body short
- tail very long; caudals short; fins small — *Chiloscyllium* (page 60)

First dorsal behind the ventrals
- second dorsal behind the anal — *Parascyllium* (page 66)

Hemiscyllium.

Hemiscyllium A. Smith, 1837, Proc. Zool. soc. Lond., p. 86; Müller & Henle, 1838, Charlesworth's mag., **2**, p. 34; 1841, Plagios., p. 16.

Body moderate, shorter than the tail. Nostrils inferior, near the end of the snout, with nasoral grooves; anterior valves reaching the mouth, widely separated by the preoral attachment, each with a long cylindrical cirrus; posterior valves with a flap at the outer side of the nostril and forming a fold on the outer side of the nasoral groove with a short free extremity at the angle of the mouth. Mouth transverse, nearer to the end of the snout than to the eye, with labial folds on both jaws around the angle, not crossing the symphyseal region; no transgeneial fold. Teeth small, tricuspid. Eye small, without a fold in the lower lid. Spiracle small, below the angle of the eye. Gill openings small, fifth widest, fourth and fifth close together. Fins rather small; dorsals larger than ventrals or anal and above the space between them. Anal close to the caudal. Subcaudal narrow, short.

Australia; Melanesia.

Front edge of dorsals with two large spots
- a large ocellate spot above the pectoral
  - origin of first dorsal above ends of ventral bases
    - spots black, round, scattered . . . *ocellatum* (page 44)
  - origin of first dorsal behind a vertical from ventral bases
    - spots brown, grouped . . . . *trispeculare* (page 45)
- a nonocellate spot above the pectoral
  - origin of first dorsal above ends of ventral fins; angle produced
    - spots dark, numerous, rounded . . *freycineti* (page 46)

Hemiscyllium ocellatum.

L'ocillé Broussonet, 1780, Mém. Acad. roy., p. 660.
Squalus ocellatus Bonnaterre, 1788, Ichth., p. 8; Gmelin, 1789, Linné Syst., **1**, p. 1494; Shaw, 1793, Nat. misc., **5**, pl. 161; Lacépède, 1798, Poissons, **1**, p. 253; Schn., 1801, Bloch Ichth., p. 129.
Hemiscyllium ocellatum Müller & Henle, 1841, Plagios., p. 16.
Scyllium ocellatum Blyth., 1847, Journ. Asiat. soc. Bengal, **16**, p. 726, pl. 25b, f. 2.
Hemiscyllium oculatum Duméril, 1853, Rev. et mag. zool., Scyll., p. 34; 1865, Elasm., p. 326.
Chiloscyllium ocellatum Günth., 1870, Cat. fishes Brit. mus., **8**, p. 410; Regan, 1908, Proc. Zool. soc. Lond., p. 359; Günther, 1910, Südsee fische, **3**, p. 488.

Elongate, head moderate, snout short, blunt, rounded. Nostrils inferior, near the end of the snout, connected with the mouth by a nasoral groove; anterior valves reaching the mouth, widely separated by the preoral attachment,

somewhat folded, with a cylindrical cirrus hardly as long as the valve; posterior valves with a fold outside of the nostril and ending in a fold on the outer side of the groove, extending to the angle of the mouth. Mouth medium, transverse, nearer to the end of the snout than to the eye, with short labial folds on both jaws around the angles, not crossing the symphyseal space. No transgeneial fold like that of Chiloscyllium. Eye small, lower lid without a fold. Spiracle moderate, below the hinder part of the eye. First gill opening smallest, third to fifth above the pectoral, fourth and fifth close together, fifth widest.

Fins rather small, angles rounded; pectorals little the larger; dorsals subequal, origin of first nearly above the end of the base of the ventral, origin of second about three times the base of the first farther back, and about two and one half times the same base forward from the anal.

Brownish, greyish or yellowish, light below, back, sides and fins with scattered irregular spots of darker brown and, on young, with ten or more indefinite transverse bands of brownish. Above the end of each pectoral base there is a large white-edged rounded spot of black.

New Holland; Australia; New South Wales.

Hemiscyllium trispeculare.

Hemiscyllium trispeculare Richardson, 1843, Icon., p. 5, pl. 1, f. 2; 1848, Erebus & Terror, Fish., p. 43, pl. 28, f. 3–7; Duméril, 1853, Rev. et mag. zool., Scyll., p. 35; 1865, Elasm., p. 326.
Chiloscyllium trispeculare Günth., 1870, Cat. fishes Brit. mus., **8**, p. 411; Regan, 1908, Proc. Zool., soc. Lond., p. 359.

Similar in outlines to *H. ocellatum*, apparently with the origin of the first dorsal a trifle farther back, the base of the anal a little shorter and the posterior extremities of the dorsals more angular. The space between the bases of the dorsals is about one and one half times the base of the second. Anal base short, nearly equal to that of the second dorsal. The mid total length is behind the first dorsal.

Body short, little more than one third of the total; snout short, blunt. Caudal region, long, slender. Nostril inferior, near end of snout, with a nasoral groove; anterior valves extending to the mouth, widely separated by the preoral attachments, with cirri; posterior valves with a fold at the outer side of the nostril, continued in a fold on the outer side of the groove with a short free extremity at the angle of the mouth. Mouth moderate, with labial folds on both jaws around the angles, not crossing behind the symphysis. No geneial fold across the chin. Eye small, lower lid without a fold. Spiracle small, below

the hinder part of orbit. Gill openings small, third to fifth above the pectoral, third and fourth close together, fifth widest. Scales small, with median keel.

Fins all short; dorsals subequal, hinder angles produced, first larger and originating behind the bases of the ventrals, distant from base of second one and one half times the base of the latter, or a little more than the distance of the latter from the origin of the anal. Subcaudal narrow.

Brownish with many small dots and spots of darker, grouped in threes and fours, and with eleven or more indefinite cross-bands of darker, separated by spaces of nearly equal width, with one or more large white-edged spots of black above the hinder part of the pectoral and with a couple of smaller spots on the front edge of each dorsal. Ventral surfaces uniform light. Type specimen 22 inches in length, a male.

Northwestern Australia.

Hemiscyllium freycineti.

Scyllium freycineti Quoy et Gaimard, 1824, Voy. Uran., Poiss., p. 192.
Scyllium malaisianum Lesson, 1830, Voy. Coquille., Poiss., p. 94, pl. 6.
Chiloscyllium malaianum Müller & Henle, 1841, Plagios., p. 20; Duméril, 1853, Rev. et mag. Zool., Scyll., p. 40; 1865, Elasm., p. 332.
Chiloscyllium freycineti Regan, 1908, Proc. Zool. soc. Lond., p. 359.

Elongate, slender; body cavity in the anterior third of the total length; head short, subconical; snout very short, blunt. Anterior nasal valves with fleshy, pointed cirri. Mouth near the end of the snout, with labial folds around the angles. Three gill openings above the pectoral, fourth and fifth close together and largest. Spiracle below the hinder part of the orbit. Dorsals subequal, hind angle produced; origin of the first dorsal above the ends of the ventral fins. Anal small, close to the caudal. Caudal short, narrow; subcaudal fin small, narrow, without a produced lobe.

Reddish brown, darker on the back; body and fins with numerous irregular rounded spots of darker; a pair of the larger spots on the front edge of each dorsal, a spot above the base of each pectoral, and several spots on the caudal. From the nape backward there appear indications of cross-bands in positions like those on *H. ocellatum* and *H. trispeculare*, and with the spots on the fins the markings are very suggestive of close affinities with those species.

Waigiu Island, New Guinea.

Brachaelurus.

Brachaelurus Ogilby, 1907, Proc. Roy. soc. Queensland, **20**, p. 27.
Cirriscyllium Ogilby, 1908, Proc. Roy. soc. Queensland, **21**, p. 4.

Form somewhat like that of Orectolobus; the body elongate and depressed anteriorly, subcylindrical posteriorly. Head broad; snout short, broad, blunt. Nostrils near the end of the snout, with nasoral grooves, and long, slender cirri. Mouth medium, transverse, with labial folds on both jaws, around the angles, and with a symphyseal fold. No transgeneial fold. Teeth small tricuspid. Eyes small. Spiracles medium, behind and partly below the eye. Gill openings small, hindmost widest, hindmost two closer together, three above the pectoral. Pectorals short, broad. Dorsals subequal; first dorsal above or behind the ventrals, second in front of the anal. Anal small, near the subcaudal. Caudal axis raised but slightly. Scales small, keeled.

Australia.

Base of the anal near the subcaudal . . . . *modestus* (page 47)
Base of anal nearly twice its length from the subcaudal . *colcloughi* (page 48)

Brachaelurus modestus.

Chiloscyllium modestum Günther, 1871, Proc. Zool. soc. London, p. 654, pl. 54.
Chiloscyllium furvum Macleay, 1882, Proc. Linn. soc. N. S. W., **7**, p. 364.
Chiloscyllium fuscum Parker & Haswell, 1897, Zoology, **2**, p. 135.
Hemiscyllium modestum Waite, 1901, Rec. Austr. mus., **4**, p. 28, f. 9, pl. 4, f. 1.
Brachaelurus modestum Ogilby, 1907, Proc. Roy. soc. Queensland, **20**, p. 27, Regan, 1908, Proc. Zool. soc. London, p. 354.
Cirriscyllium modestum Ogilby, 1908, Proc. Roy. soc. Queensland, **21**, p. 3.

Body moderate; head broad, depressed; snout short, broadly rounded in front; caudal region longer than the body cavity. Nostrils inferior, nearer to end of snout than to mouth; anterior narial valves reaching the mouth, each with an elongate cirrus; posterior valves with a fold on outer side of nostril and continued in a fold on the outer side of the nasoral groove with free end at angle of the mouth. Mouth medium, with long labial folds, on both jaws, around the angles, not meeting behind the symphysis on the chin. No transgeneial fold, a short longitudinal groove at the symphysis. Teeth small, tricuspid, median cusp largest, several series in function. Eye small. Spiracle smaller than the eye, behind and below the posterior portion, with raised border. Gill openings small, third to fifth above the pectoral, fourth and fifth little closer together.

Fins of moderate size, angles not produced. Dorsals subequal; origin of first above the middle of the bases of the ventrals, base extended little beyond the ends of these fins and ending about mid total length; base of second distant from that of first little more than half its length. Anal small, near the caudal, origin below the end of the base of the second dorsal. Caudal short, lower subcaudal margin a broad convex, not lobed. Claspers ending in a slender, sharp, flexible point.

Brownish to greyish brown, back darker, belly yellowish; young with about ten transverse bands of darker on back and sides, separated by narrower spaces, with irregular scattered small spots of whitish on body and fins. Adults more nearly uniform brownish.

New South Wales.

Brachaelurus (Heteroscyllium) colcloughi.

Brachaelurus colcloughi Ogilby, 1908, Proc. Roy. Soc. Queensland, **21**, p. 3.
Heteroscyllium colcloughi Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 455.

Body robust. Preoral length one third of that of the head. Anterior angle of the nostril equidistant from the mouth and the tip of the snout; internarial width about equal the preoral length, eight ninths of the width of the mouth; nasal cirrus five sevenths of the preoral length, not extending to the lower labial groove, one and one half times the diameter of the eye. Mouth much nearer to the eye than to the tip of the snout, width seven sixteenths of the length of the head. Eye somewhat nearer to the tip of the snout than to the first gill opening, length of orbit six and two fifths times in the length of the head. Spiracle smaller than the eye. Length of body to vent four fifths of the caudal length. Origin of the first dorsal above the middle of the bases of the ventrals, hind angle pointed. Second dorsal similar in shape to the first, somewhat smaller. Distance between the origin of the anal and the second dorsal less than the interdorsal space; free space between the anal and the caudal less than twice the length of the anal base. Distance of the pectoral from the ventrals two thirds of that from the tip of the snout; pectoral base rather more than half the greatest width of the fin, and rather less than half the length, which is six sevenths of that of the head. Origins of the ventrals a little nearer to the first dorsal than to the pectorals.

Back, flanks and tail ashy grey; lower surfaces white.

Type about 18.1 inches (460 mm.).

Coasts of Queensland; Moreton Bay.

Orectolobus.

Orectolobus Bonaparte, 1834, Icon. Fauna Ital., Pesci, fasc. 7.
Crossorhinus Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 113.

Body stout, depressed, cavity half or more of the total length; tail shorter, slender, compressed. Head and snout flattened above, broad, blunt. Nostrils at the end of the snout, connected with the mouth by a nasoral groove; anterior nasal valve with a cirrus. Mouth transverse, nearly terminal, with labial folds on both jaws around the angles. Teeth compressed, narrow, with or without small lateral denticles. Eye small, orbit elongate. Spiracle moderate, behind and below the eye. Gill openings narrow, third to fifth above the pectoral, fourth and fifth close together. Dorsals above the space between the ventrals and the anal. Anal small, close to the subcaudal. Caudals narrow, other fins short and broad; a notch between the subcaudal and the terminal. The largest species reach a length of eight feet or more.

Transgeneial folds, like those of Chiloscyllium, are absent, but on some perhaps all of the species there is a short longitudinal fold below the symphysis of the lower jaws, similar to that noted on species of Hemiscyllium, suggesting a distensible mouth aperture with elastic ligaments, as in some serpents.

No orbital papilla
  dermal lobes simple . . . . . *ornatus* (page 49)
  dermal lobes bifid to trifid . . . . . *japonicus* (page 50)
One orbital papilla
  one dermal lobe at side of throat . . . *tentaculatus* (page 51)
Two orbital papillae
  two dermal lobes at side of throat
    a few short lobes below the chin . . . *maculatus* (page 52)

Orectolobus ornatus.

Crossorhinus ornatus De Vis, 1883, Proc. Linn. soc. N. S. W., 8, p. 289.
Orectolobus ornatus Regan, 1908, Proc. Zool. soc. London, p. 356, pl. 11, f. 2.

Closely allied to *O. maculatus*, but differing in that the nasal cirrus and the dermal lobes are less developed and more simple. The lobes occupy similar positions; that is, there are two above the upper lip, two at the angle of the mouth and two at the side of the head, but they are not bifid or trifid at their ends. Gill openings small, hindmost two closer together, three above the pectorals. Mouth moderate; lower labial folds long, not crossing the symphysis.

A short symphyseal fold below the chin. Fins with rounded angles and slightly convex free margins. Dorsals subequal; base of second dorsal longer than the interdorsal space; origin of first dorsal above the ends of the bases of the ventrals. Anal small, origin below the tip of the second dorsal. Subcaudal longer than the anal; separated from the terminal by a notch.

Greyish brown, with irregular blotches of brown crossing the body at the nape, between the pectorals, forward of the ventrals, through the dorsals, through the anal and across the caudal. Fins blotched. A lighter spot above each eye.

Queensland.

Orectolobus japonicus.

Plate 56, fig. 3, (heart).

Crossorhinus barbatus Müller & Henle, 1841, Plagios., p. 21, pl. 5; Schlegel, 1850, Jap. Pisces, p. 301; Duméril, 1865, Elasm., p. 338 (part); Günth., 1870, Cat. fishes Brit. mus., **8**, p. 414 (part).
Orectolobus barbatus Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 606.
Orectolobus japonicus Regan, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 435; 1908, Proc. Zool. soc. Lond., p. 356.

Elongate, depressed in head and body, body cavity half or more of the total; head one fifth, longer than broad; tail slender, compressed in the posterior half. Snout short, broad, blunt, extending very little beyond the mouth. Nostrils below the end of the snout, connected with the mouth by a nasoral groove; anterior valves reaching the teeth, somewhat lobed and fringed, with a median attachment, separated from one another, by a median preoral lobe to which they are attached; each valve with a long slender cirrus, twice as long as the valve, bearing a lobe or fold on the proximal half of the inner side; posterior valves forming a fold around the outer side of the nostril and subcontinuous with the upper lateral fold and a fold along the outer side of the nasoral groove to end in a cirrus or slender point toward the angle of the mouth. Mouth wide, subterminal, close to the end of the snout, with long labial folds, on both jaws, around the angles, the lower almost reaching the symphysis. No transgeneial fold; a short longitudinal fold below the symphysis. Teeth moderate, compressed, with a narrow sharp triangular cusp on three lobes at the base.

Eyes small, prominent, hardly one third of length of snout, without a fold in the lower lid, without dermal prominences on the top. Spiracles large, twice as long as the eye, lower than the eye and behind a vertical from its hinder angle, elongate, oblique. Above the upper lip there is a group of three barbels, second shortest, third longest. Behind the angle of the mouth on a fold there are five, the first two of which are not entirely separated, the second two more completely,

and the fifth is bifid near the end. Behind these at the side of the throat there are two short bifid lobes, separated by the length of the eye from one another and by twice as much from those at the angle of the mouth. Scales small, pluricarinate or striate.

Pectorals short, little longer than wide, width about equal their distance from the ventrals, ends truncate, angles blunt. Dorsals subequal, angles slightly produced, ends slightly concave; origin of first dorsal behind the mid length, nearly above the ends of the bases of the ventrals, base separated by less than its length from the second; base of second ending about one length of the orbit forward of the anal. Anal small, rounded, narrow, close to subcaudal, base equal half length of subcaudal, nearly equal to base of first dorsal. End of caudal fan-shaped, broadening outward.

Rusty marbled brownish, with light edged spots, and with ten or more irregular transverse blotches of darker: first blotch across occiput and nape, second between the pectorals, third above the space between pectorals and ventrals, the fourth at the origin and the fifth at the end of the first dorsal, the seventh at the end of the second dorsal and the eighth and two or more others across the caudal. The blotches are dark more or less edged with light; some contain ocellate spots. A small spot of white behind each spiracle. A dark spot on the interorbital space; pectorals and ventrals with dark blotches. Lower surfaces uniform light brownish.

The specimen described, from Japan, closely agrees with the figure published by Müller and Henle.

Orectolobus tentaculatus.

Crossorhinus tentaculatus Peters, 1864, Monatsb. Berl. akad., p. 123; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 414; Macleay, 1881, Proc. Linn. soc. N. S. W., **6**, p. 365.
Orectolobus tentaculatus Regan, 1908, Proc. Zool. soc. Lond., p. 357.

In most features like *O. maculatus*. Nasal cirri long, simple. A small wart-like papilla above each eye posteriorly. Dermal lobes simple; one above the upper lip, one at the angle of the mouth and another at the side of the head. Gill openings small, three above the pectoral, hindmost two close together. Spiracle moderate, behind and below the eye. Pectorals short, broad, rounded. First dorsal the longer, origin nearly above the ends of the bases of the ventrals. Second dorsal entirely forward of the anal, base longer than the interdorsal space. Anal close to the subcaudal. Fin angles more rounded and edges more convex in the young.

Yellowish grey with light-edged blotches of darker: one blotch on the nape,

a larger one between the pectorals, a third forward from the ventrals, and others across each dorsal and the anal. Posteriorly the blotches extend downward more on the flanks. Fins with dark spots. A lighter spot behind each spiracle.

Queensland.

Orectolobus maculatus.

Le barbu Broussonet, 1780, Mém. Acad. roy., p. 657.
Squalus maculatus Bonnaterre, 1788, Ichth., p. 8.
Watt's shark Philipp, 1789, Voy. Botany Bay, p. 285.
Squalus barbatus Gmelin, 1789, Linné Syst., **1**, p. 1493; Schn., 1801, Bloch Ichth., p. 128.
Le squale barbu Lacépède, 1798, Poissons, **1**, p. 247.
Squalus lobatus Schn., 1801, Bloch Ichth., p. 137.
Squalus appendiculatus Shaw, 1806, Nat. misc., **17**, pl. 727.
Chrossorhinus lobatus A. Smith, 1837, Proc. Zool. soc. Lond., p. 86.
Crossorhinus barbatus Duméril, 1865, Elasm., p. 338 (part); Günth., 1870, Cat. fishes Brit. mus., **8**, p. 414.
Crossorhinus barbatus McCoy, 1880, Zool. Vict., **5**, pl. 43, f. 1; Macleay, 1881, Proc. Linn. soc. N. S. W., **6**, p. 365.
Orectolobus barbatus Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 606; Regan, 1908, Proc. Zool. soc. Lond., p. 355.

Body and head broad, little more than half of the total length; tail slender, compressed posteriorly. Head depressed, snout very short, broad. Eye small, prominent, opening longer than wide. Spiracles large, elongate, oblique, close behind and below the eye. Nostrils anterior, connected with the mouth by a nasoral groove; anterior valve with a long cirrus on the upper half of which there is a dermal fold with one or more short lobes; posterior valves forming a fold at the outer side of the nostril and continuing into the upper labial fold and a longitudinal fold along the outer side of the nasoral groove the free pointed extremity of which extends toward the angle of the mouth. Mouth wide, nearly anterior, with labial folds around the angle on both jaws. Teeth moderate, anterior larger with a single narrow elongate cusp and a broadened base, posterior small with a more or less developed lateral cusp at each side of the median. A couple of dermal folds or barbels, ending in bifid or trifid lobes at the angle of the mouth, a couple more at the side of the throat, and a few very small ones below the chin. A prominent ridge over and above each eye, bearing processes above the orbit.

Dorsals subequal, subangular, base of first dorsal equal to their distance apart. Anal short, origin nearly below tip of second dorsal.

Greyish brown to brown spotted and mottled with various shades of darker, commonly with larger blotches on the back and across the tail. Many of the brown areas edged with lighter. Lower surfaces plain.

Australian Seas.

Eucrossorhinus.

Eucrossorhinus Regan, 1908, Proc. Zool. soc. Lond., p. 357.

Head broader and more depressed, eyes smaller, spiracles larger, and dermal lobes around the head more numerous and more dissected than in the species of Orectolobus. A series of branching dermal lobes below the lower jaws and a nearly continuous series from the narial lobe to the base of the pectoral. Dorsals smaller than the ventrals. Anal smaller than the dorsals, close to the subcaudal; latter narrow, separated by a notch from the terminal.

Probably a subgenus of Orectolobus.

Eucrossorhinus dasypogon.

Crossorhinus dasypogon Bleeker, 1867, Arch. Neerl., p. 400, pl. 21, f. 1.
Eucrossorhinus dasypogon Regan, 1908, Proc. Zool. soc. Lond., p. 357.

Elongate, depressed in body and head; tail nearly half of the total length, compressed posteriorly; snout short, broad. Eyes small. Spiracles large, two or more times the length of the eyes. Nostrils at the end of the snout; anterior valves with a long cirrus on one side of which there is a fold with several lobules; posterior valves forming a fold around the outer side of the nostril and continuing backward into the fold of the upper lip and another along the side of the nasoral groove and ending in a cirroid free extremity toward the angle of the mouth. Between the narial lobe and that at the angle of the mouth there are about five lobes, and between the angle of the mouth and the pectoral there are about twenty more, of which six or eight are on the fold extending from the angle. Sixteen or twenty more form a transverse series behind the lower lips. Pectorals short, broad, rounded. Dorsals subequal, rounded; origin of first dorsal above the hindmost fourth of the base of the ventrals, base ending about its length forward from the second dorsal. Anal much shorter than the dorsals, origin behind the base of the second dorsal, narrowly separated from the subcaudal.

Brown profusely marked with small spots of white; a small spot of white behind each spiracle; caudal region with four of five indefinite irregular transverse areas of darker; lower surfaces light, plain.

Bleeker's description and figure were drawn from two specimens, a male of 220 mm. and a female of 800 mm., taken off Waigiu, Aru, New Guinea.

Ginglymostoma.

Ginglymostoma Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 113; 1841, Plagios., p. 22.

Body medium, depressed and broadened forward, compressed posteriorly. Head broad, snout short, blunt. Nostrils near the end of the snout; anterior nasal valves reaching the mouth, broadly separated by attachment across the symphysis, each with a cylindrical cirrus at the outer edge; posterior valve a fold on the outer side of the groove. Mouth wide, little curved, inferior. Teeth small, in $\frac{28}{27}$ or more rows, compressed 3–5 cusped, with a strong sharp cusp at each side of which there is a pair of denticles, median cusp strongest, several series in function, eyes small, without a fold. Spiracle minute, at a distance behind the eye. Gill openings, moderate, fourth and fifth widest and above the pectoral, close together. Dorsals approximated, rather large, first above the ventrals, larger; second origin forward of anal. Caudal large, subcaudal not lobed.

Tropical Atlantic, Pacific, and Indian Oceans.

Fin angles rounded
- anal small
  - cirrus as long as narial valve
    - subcaudal narrow . . . . . *cirratum* (page 54)
- anal large
  - cirrus much shorter than narial valve
    - subcaudal deep . . . . . *brevicaudatum* (page 55)

Fin angles sharp
- cirrus hardly reaching the teeth
  - subcaudal feebly lobed . . . . *ferrugineum* (page 56)

Ginglymostoma cirratum.

Plate 7, fig. 4–6.

Le Barbillon Broussonet, 1780, Mem. Acad. roy., p. 656.
Gata Parra, 1787, Hist. nat., p. 86, pl. 34, f. 2.
Squalus cirratus Bonnaterre, 1788, Ichth., p. 7; Gmelin, 1789, Linné Syst., **1**, p. 1492; Lacépède, 1798, Poissons, **1**, p. 245; Schn., 1801, Bloch Ichth., p. 128.
Squalus punctulatus Lacépède, 1800, Poissons, **2**, p. 120, pl. 4, f. 3; Schn., 1801, Bloch Ichth., p. 549.
Squalus punctatus Schn., ibid., p. 134.
Squalus argus Bancroft, 1835, Zool. journ., **5**, p. 82.
Ginglymostoma cirratum Müller & Henle, 1841, Plagios., p. 23; Duméril, 1865, Elasm., p. 334; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 408.
Ginglymostoma fulvum Poey, 1861, Memorias Cuba, **2**, p. 342; 1868, Repertorio, p. 455.
Ginglymostoma caboverdianus Capello, 1867, Jor. sci. math. phys. nat. Lisboa, **1**, p. 167, f. 1.

Body cavity nearly one half of total length, head about one fifth and caudal not far from two sevenths. Body and head broad and depressed anteriorly, width of head equal to its length to the first gill opening. Eye very small, elongate. Spiracle pore-like, lower than the eye and one length farther back; farther from the eye than on *G. brevicaudatum*. Nostrils small, near the end of the snout, connected with the mouth by a nasoral groove, anterior valves with a cirrus extending to the mouth cleft, widely separated by the preoral attachment across which a ridge passes from one valve to the other. Mouth moderate, lips swollen, extending over about half the length of each jaw. Teeth small, about $\frac{30}{28}$ rows on specimens of 15 inches or less, several series in function, compressed, with a strong sharp median cusp and small lateral denticles (1 or 2) on each side of it. Gill openings small, first about twice the length of the eye, posterior widest, fourth and fifth close together above the pectoral. Fin angles broadly rounded. Pectorals larger than the first dorsal; origin of first dorsal little forward of the mid length total, opposite or little backward of that of the ventral. Second dorsal more than half as long as the first, one length of the base from that of the latter.

Anal much smaller than second dorsal, and origin below the middle of its base which ends below the middle of the space between end of second dorsal base and origin of caudal. Subcaudal long, rather narrow.

Scales small, with a low keel or smooth, hinder edges sharp, those on upper edge of caudal and about openings of pores larger.

Colors of large individuals brown, yellowish to plumbeous, of young yellowish to light brownish, most often with scattered small spots of brown; in cases with a transverse band of brownish across the snout, another through the first dorsal and ventrals, a third through the second dorsal and the anal; lower surfaces lighter.

Tropical Atlantic and Eastern Pacific.

GINGLYMOSTOMA BREVICAUDATUM.

Ginglymostoma brevicaudatum GÜNTH., 1866, Fishes Zanzibar, p. 141, pl. 21; 1870, Cat. fishes Brit. mus., 8, p. 408.

Head broad depressed, snout broad and broadly rounded at the end, broader, thicker and less pointed than that of *G. cirratum*. Eye minute. Spiracles small, distant from the eye one length of the latter. Nostrils small; anterior valves reaching the lip, separated by the very broad preoral attachment, with a cirrus half as long as the valve; posterior valve a fold on the outer side of the

nasoral groove. Mouth wide, labial folds crossing half or more of the distance from the angles to the symphysis on the lower jaw and little less on the upper. Teeth small, on a 23 inch specimen in $\frac{29}{27}$ rows, in several functional series, commonly with a strong hooked median cusp at each side of which there is a denticle. Fourth and fifth gill openings wider than the first, close together, above the pectoral. Fins short, broad, convex on the margins, rounded on the angles. Origin of first dorsal opposite the middle of the base of the ventral, end one length in front of the base of the second dorsal. Origin or end of base of second dorsal little forward of those of the anal. Anal little smaller than second dorsal, position slightly backward. Subcaudal short and deep, not lobed anteriorly.

Scales small, with quadrangular exposure, with 3–9 keels or smooth, with hinder edges notched by the keels or entire.

Uniform brown, young with small spots of black.

Zanzibar and Seychelles; Indian Ocean.

Ginglymostoma ferrugineum.

Scyllium ferrugineum Lesson, 1830, Voy. Coquille, Poiss., p. 95.
Ginglymostoma concolor Müller & Henle, 1841, Plagios., p. 22, pl. 6.
Ginglymostoma mülleri Günth., 1870, Cat. fishes Brit. mus., **8**, p. 408; Klunzinger, 1871, Syn. fische, **2**, p. 230; Day, 1878, Ind. fishes, p. 725; Günth., 1910, Südsee fische, **3**, p. 487.
Ginglymostoma ferrugineum Jord. & Snyder, 1906, Bull. U. S. fish. comm., **25**, p. 182; Regan, 1908, Proc. Zool. soc. Lond., p. 51.

Head depressed; snout short, moderately broad, more pointed than that of *G. brevicaudatum*, bluntly rounded. Anterior nasal valves reaching the mouth, cirrus much shorter, hardly half as long as the valve. Teeth small, with a strong median cusp and several, 3–5, smaller lateral cusps, several rows in function. Fins short, with rather sharp angles; dorsals moderately large, origin of the first nearly opposite that of the ventral, base little more than distance from that of second, more than base of second. Anal little smaller than second dorsal, bases equal, hinder angle produced. Caudal nearly $\frac{1}{3}$ of total length.

Scales small, with obtuse central keel, crenulate on the hind margin.

Uniform rusty brown.

India and East Indies.

Nebrodes.

Nebrius Rüppell, 1837, Beschr. Chondropt., p. 2; 1838, Neue wirb., fische, p. 62.

Closely allied to Ginglymostoma but readily distinguished by the teeth,

which are different in shape and much less numerous; there is a smaller number of series in function at the same time, apparently not more than one.

Snout hardly as broad as that of Ginglymostoma. Eyes very small. Spiracles minute, about one length of the orbit behind the eye. Nostrils connected with the mouth by nasoral grooves; anterior valves with cylindrical cirri, reaching the mouth, widely separated by their preoral attachment, posterior valve a fold on the outer side of the groove at the angle of the mouth. Mouth rather small; lips swollen, lower shorter. Teeth small, polycuspid, compressed, one or two series in function. Fourth and fifth gill openings close together, above the pectoral.

Indian Ocean.

First dorsal above the ventral, second above the anal
first dorsal distant from second less than length of base . *concolor* (page 57)
first dorsal distant more than the length of its base from that of second.
macrurus (page 58)

Nebrodes concolor.

Nebrius concolor Rüppell, 1837, Beschr. Chondropt., p. 2, pl. 17, f. 2; 1838, Neue wirb., fische, p. 62, pl. 17, f. 2.

Ginglymostoma concolor T. Cantor, 1849, Malay. fishes, p. 395; Günth,, 1870, Cat. fishes Brit. mus., **8**, p. 409.

Ginglymostoma rüppellii Bleeker, 1852, Plagios., p. 91; 1852, Nat. tijds. Ned. Ind., **3**, p. 83; Duméril, 1865, Elasm., p. 334.

Snout bluntly rounded. First dorsal much larger than second, bases of the two separated by the length of the base of the second, origin of the first directly above the bases of the ventrals. Caudal $\frac{1}{3}$ of the total, with the merest suggestion of a lower lobe. Teeth small, in several transverse series of which only one is in function; each tooth with a convex cutting edge formed of small cusps the median of which is stronger. Angles of pectorals, ventrals, dorsals, and anal sharp. Cirrus shorter than the narial valve.

Color brownish or rusty brown.

Distinguished from *N. macrurus* by the size of the first dorsal, its distance from the second, its origin above that of the ventral, and by the sharp angles of the fins.

Red Sea to India.

NEBRODES MACRURUS, sp. nov.

Plate 8, fig. 7–10.

Body moderately slender, tapering backward from the shoulders. Head depressed; snout short, blunt. Nostrils near the end of the snout, anterior nasal valve with a long cylindrical cirrus, posterior valve a fold on the side of the nasoral groove. Mouth moderate, nearly transverse, nearer to end of snout than to eye, with strongly developed labial folds that are widely separated across the symphyseal space; jaws much arched forward; teeth in about $\frac{30}{28}$ rows, one transverse series in function, much compressed, each with a low median cusp at each side of which there are 4 or more smaller ones gradually decreasing in size toward the outer. The one series in function with the continuous edge of sharp cusps in some measure recalls what obtains on the jaws of Heptranchias and suggests an intermediary position between its dentition and that of such a form as Catulus or others with compressed pluricuspids. Eye small, opening elongate, length about $\frac{1}{5}$ the width of the mouth. Spiracle small, minute, behind the eye, distant one ocular diameter. Gill apertures as wide as the space between the labial folds on the middle of the mouth; fourth and fifth much narrower and closer together, above the pectoral. Fin angles blunt, inner more rounded, hinder edges more or less sinuous. First dorsal somewhat larger than the second, base entirely in front of total mid length, about as long as high, base distant near $1\frac{1}{2}$ times its length from that of the second, originating little forward of the middle of the base of the ventral. Second dorsal smaller than first, origin forward of that of the anal. Anal more oblique, more pointed, longer in base and extending farther backward than second dorsal. Caudal long, near $\frac{1}{3}$ of the total; subcaudal portion deep anteriorly, with a slight lobe, tapering gradually backward. Pectorals wide, length $\frac{2}{3}$ of the width, slightly falcate. Ventrals near the size of the first dorsal, one and one half times as long as broad.

Scales small, resembling those of particular Centrophori, rather smooth to the touch, bearing a low median keel with or without smaller lateral keels, larger scales intermixed with the smaller, hinder edges not crenulate.

Rusty brownish, with a sprinkled appearance, from the larger whiter scales.

Distinguished from *N. concolor* Rüpp. among other features by less difference in the sizes of the dorsals, by the smaller size of the first dorsal and its greater distance from the second, by the larger anal, and by the longer cirrus.

Type No. 820, M. C. Z., Port Louis Harbour, Mauritius; a male of $31\frac{1}{2}$ inches, body cavity 15 in.

Stegostoma.

Stegostoma Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 112; Wiegm. archiv., p. 395; 1838, Charlesworth's mag., **2**, p. 35; 1841, Plagios., p. 24.

Body slender, less than half the total; head short broad; snout short thick blunt; tail long, slender, compressed. Nostrils with a nasoral groove; anterior valves united in a broad thick pad in front of the preoral fold, each with a cylindrical cirrus; posterior valves reduced to a narrow fold on the outer side of the groove, terminating in a short flap at the angle of the mouth. Mouth transverse, upper lip thin, between the nasal valves and the teeth; labial folds short, around the angles. Narial valves, preoral fold, and chin invested with modified scales. Teeth small, tricuspid, in transverse pads, of about 28 rows each. Eyes small, lids without folds. Spiracles small, behind the eyes. Gill openings small, fourth and fifth close together, hinder three above the pectoral. Dorsals approximated, small; first larger, above the ventrals; second smaller than the anal and farther forward. Anal near the caudal. Caudal long, horizontal; subcaudal narrow, not lobed.

East Indies; India; Africa.

Stegostoma varium.

Squalus sp. Gronow, 1754, Mus., **1**, p. 62.
Squalus varius Seba, 1761, Thesaur., **3**, p. 105, pl. 34, f. 1; Gronow, 1763, Zoophy., **1**, p. 33, no. 147.
Le Tigre Broussonet, 1780, Mem. Acad. roy., p. 658.
Squalus tigrinus Forster, 1781, Zool. Ind., p. 24, pl. 13, f. 2; Bonnaterre, 1788, Ichth., p. 8, pl. 8, f. 23; Gmelin, 1789, Linné Syst., **1**, p. 1493; Lacépède, 1798, Poissons, **1**, p. 249.
Squalus fasciatus Hermann, 1783, Tab. affin., p. 302, tab.; Bloch, 1785, Ausl. fische, **1**, p. 19, pl. 113; Shaw, 1800, Nat. misc., **11**, pl. 434; Schn., 1801, Bloch Ichth., p. 130.
Squalus longicaudus Gmelin, 1789, Linné Syst., **1**, p. 1496.
Pollee Makum Russell, 1803, Coromandel fishes, **1**, pl. 18.
Scyllium heptagonum Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 61, pl. 17, f. 1.
Stegostoma fasciatum Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 113; Wiegm. archiv., p. 395; 1838, Charlesworth's mag. **2**, p. 35; 1841, Plagios., p. 24, pl. 23; T. Cantor, 1849, Malay. fishes, p. 396; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios. p. 23; Duméril, 1865, Elasm., p. 386; Günth., 1866, Fishes Zanzibar, p. 140.
Stegostoma carinatum Blyth, 1847, Journ. Asiat. soc. Bengal, **16**, p. 725, pl. 25 b, f. 1.
Stegostoma cirrosus Gray, 1854, Gron. syst., p. 6.
Stegostoma tigrinum Günth., 1870, Cat. fishes Brit. mus., **8**, p. 409; Regan, 1908, Proc. Zool. soc. Lond., p. 363; Tanaka, 1911, Fishes of Japan, **4**, p. 65, pl. 16.

Body and tail compressed; on a thirteen inch specimen the body cavity is one third and the caudal more than one half of the total length. Head broad, thick, crown convex; snout short, broadly rounded in front. Nostrils near the end of the snout, connected with the mouth by a nasoral groove, anterior valves fused into a broad pad free at the preoral edge, each with a slender cylindrical

cirrus extending to the lips. Mouth inferior, transverse, with short labial folds around the angles, and with a preoral fold in front of the upper teeth behind the narial flap. Eye small. Spiracle small, wider vertically, behind and near the orbit. Width of first gill opening equal length of orbit, hindmost three of the openings above the pectoral, fourth and fifth widest, overlapping.

Dorsals ventrals and anal small; subcaudal narrow, not lobed. Base of first dorsal equal the space between it and the second, middle above origin of ventral and end slightly forward of end of ventral base. Second dorsal smaller, origin above the middle of the space between ventrals and anal, end of base above the origin of the anal. Base of anal about equal to that of the second dorsal, fin longer. Caudal not raised from the axis of the body. On the specimen described the vertebral column protrudes below the supracaudal.

Brown on back and sides, with six cross-bands or blotches of yellow on the body, and twenty-two on the tail: the anterior crosses the occiput to the bases of the pectorals, the second crosses above the pectorals and extends obliquely backward and down to the fins, this band is followed by a dorsal spot behind which the bands are more vertical and more irregular; on the tail they divide so as to form a series of spots on the lower part of each side. Belly white.

Günther describes an individual as brownish yellow with black or brown cross bands or stripes or with snuff-colored rounded spots. Rüppell figures another as brownish with spots and bands of brown. Individual variations appear to connect these extremes.

A specimen about five feet in length is brownish with faint transverse cloudings of brown on the body; it bears numerous round spots of dark brown, as large as the eye or smaller, beginning as dots about the eyes on the head and extending back and downward to the ventrals. Behind the first dorsal the spots become less numerous and more scattered; they disappear near the root of the caudal.

India and East Indies to Africa.

Chiloscyllium.

Chiloscyllium Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin., p. 112; Wiegm. archiv., p. 395; 1838, Charlesworth's mag., **2**, p. 34; 1841, Plagios., p. 17.
Synchismus Gill, 1861, Ann. N. Y. lyc., **7**, p. 413.

Elongate; body less than half of the total length; head short, depressed, narrowed above and forward; tail long, slender. Eyes small, lower lid without a fold. Spiracle small, below hind part of the eye, without or with a process on the hind margin. Nostrils inferior, near the end of the snout, with a nasoral

groove; anterior nasal valves reaching the mouth, widely separated by the median preoral attachment, each valve with a long pointed cirrus; posterior valves forming a fold at the outer side of the nostril, continued in a fold on the outer edge of the nasoral groove with a short free extremity. Mouth transverse, with labial folds, around the angles, and with a transgeneial fold across the chin below the symphysis. Teeth small, compressed, median cusp triangular with or without smaller lateral cusps at its base, three or more series in function. Gill openings narrow, hindmost two wider and close together, hindmost three above the pectoral. Fins medium to small; dorsals above the space between ventrals and anal; anal and subcaudal narrow, close together.

India and China to Australia. Fossil species are known from the Miocene.

One dermal ridge on the back
anal shorter than the subcaudal
origin of the first dorsal above forward half of ventral bases
dorsals larger than the ventrals, hind angles produced
punctatum (page 61)
origin of first dorsal above middle of ventral bases
dorsals smaller than the ventrals, hind angles not produced
body with transverse bands and white spots
plagiosum (page 62)
origin of first dorsal above ends of ventrals
dorsals smaller than ventrals, hind angles rounded
body with transverse bands and spots of dark
griseum (page 64)

Three dermal ridges on the back; fins all small
anal as long as the subcaudal
origin of first dorsal above ends of ventrals
dorsal fins equal ventrals, hind angles not produced
indicum (page 65)

Chiloscyllium punctatum.

Chiloscyllium punctatum Müller & Henle, 1841, Plagios., p. 18, pl. 3; Bleeker, 1852, Plagios, p. 22; Duméril, 1865, Elasm., p. 330; Günth., 1870, Cat. fishes Brit. mus., p. 413; Regan, 1908, Proc. Zool. soc. Lond., p. 360.
Chiloscyllium griseum, Müller & Henle, 1841, Plagios, pl. 4.

Elongate, slender, subcylindrical, body cavity more than one third, head about one sixth, of the total length. Snout moderate, broad and blunt. Nostrils with nasoral grooves; anterior valves extending to the teeth, cirri longer, with a free angle behind the preoral attachment; posterior valves forming a fold

outside of the nostril, continued in a fold along the outer side of the groove, subcontinuous with the upper labial folds, with a short free end at the angle of the mouth. Mouth medium, with short labial folds around the angles, and with a deep transgeneial fold below the symphysis. Teeth small, triangular, compressed, cusps with or without feeble lateral cusps. Eye small, elongate. Spiracle small, below the hinder part of the eye, with a low tubercle on the margin. Gill openings moderate, hindmost widest, third to fifth above the pectoral, fourth and fifth close together. Scales minute, sharp, with a median keel.

Dorsal fins larger than the ventrals, bases equal, second little smaller, hinder angles produced, sharp, hind margins deeply concave; origin of first above forward portion of ventral base; origin of second about one length of base farther back and one half length of base forward of the anal; extreme end of second dorsal nearly above the origin of the anal. Anal fin short, narrow, base equal two thirds of that of the subcaudal, width of free portion of the fin about half the base. Pectorals rather narrow, angles rounded, hinder margins oblique.

A seventeen inch specimen is brownish, with ten or more broad bands of darker, wider than the interspaces: first band across the nape, second in front of the first dorsal, third through the hinder part of the same fin, fourth in front of and fifth through the posterior half of the second dorsal, sixth through the anal, and the others through the caudal. Some individuals are more or less spotted with small areas of brown. The front edges of the gill openings are white. A male of more than 26 inches is about uniform brown but retains the white edges of the gill openings; he has a few scattered spots of brown.

Description from specimens taken at Singapore and at the Philippines. This is probably a species of which individuals reach a considerable size; on the male mentioned the claspers are very small and immature. A specimen from southern Celebes does not differ from those described above.

Chiloscyllium plagiosum.

Bokee Sorrah Russell, 1803, Coromandel fishes, **1**, p. 10, pl. 16.
Ra Sorrah Russell, 1803, ibid.
Scyllium plagiosum, Bennett, 1830, Mem. Raffles, p. 694.
Scyllium ornatum Gray & Hardwicke, 1832, Ill. Ind. zool., **1**, pl. 98, f. 2.
Chiloscyllium plagiosum Müller & Henle, 1841, Plagios., p. 17 (part); T. Cantor, 1849, Malay. fishes, p. 392; Bleeker, 1852, Plagios., p. 17; Duméril, 1865, Elasm., p. 328; Day, 1865, Fishes Malabar, p. 267.
Chiloscyllium margaritiferum Bleeker, 1864, Faune ichth. Obi, p. 5.
Chiloscyllium indicum Günth., 1870, Cat. fishes British mus., **8**, p. 412 (part).
Chiloscyllium indicum var. *plagiosa* Günth., 1870, ibid.
Chiloscyllium indicum Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 605, f. 2.
Chiloscyllium plagiosum Regan, 1908, Proc. Zool. soc. Lond., p. 362, pl. 12, f. 1.

Form elongate, slender; tail longer than body; head short, crown and forehead convex longitudinally and somewhat flattened transversely; snout narrowing forward, short, blunt. Eye small, no fold in the lower lid. Spiracle smaller than the eye, below the posterior extremity of the orbit, with a low process on the edge. Nostrils with a nasoral groove; anterior valves and cirri reaching the mouth, widely separated by the preoral attachments; posterior valves forming a fold on the outer side of the nostril and continuing in a fold along the outer side of the nasoral groove to end at the angle of the mouth with a very short free end. Mouth with short lateral folds on both jaws around the angles, and with a transgeneial fold behind the symphysis, covering the lower labial folds, its hinder margin of considerable width and more or less scalloped. Gill openings narrow, hindmost widest, third to fifth above the pectoral, fourth and fifth close together. Scales small, irregular, carinate, smooth on large individuals.

Fins moderate; pectorals broad, margins and angles broadly rounded. Dorsals subequal, hind margins nearly straight, angles not produced; origin of first dorsal above end of base of ventral, distance from second less than twice the length of the base; origin of second two lengths of its base forward of the anal. Base of anal longer than base of second dorsal, equal to two thirds of that of the subcaudal. Caudals narrow. Fin margins more convex on the young.

Greyish brown, lighter beneath, with about twelve irregular transverse blotches of darker on the back: the first on the crown, the second between the pectorals, the third at the tips of the pectorals, the fourth at the origin and the fifth at the end of the first dorsal, the sixth at the origin and the seventh at the end of the second dorsal, the eighth at the origin of the caudal, and the others upon the caudal fin. On young specimens the anterior blotches enclose white spots on the edge of the snout, at the side of the nostril, above each eye, and two or more in each of the forward bands. The ground color is lighter on small ones and on some dark spots are scattered over the body and white markings on the edges of the fins. Adults are less spotted and are darker; some of them nearly uniform brown.

Specimens described here are from Hong Kong. Of other localities Siam, while close to the Chinese, exhibits more and larger spots of light color; Singapore types are more spotted with brown, the white spots also being present, and the young have the brown blotches darker, the dark edges becoming series of spots on larger specimens. On Penang examples the ground colors are much lighter and the dark edges of the blotches are more broken into series of small

spots. Females are adult at twenty-eight inches; the largest at hand is thirty-two inches in length.

Chiloscyllium griseum.

Chiloscyllium griseum Müller & Henle, 1841, Plagios., p. 19; Regan, 1908, Proc. Zool. soc. Lond., p. 360, pl. 11, f. 1, pl. 13, f. 3, juv.
Chiloscyllium plagiosum Müller & Henle, 1841, loc. cit., p. 18; T. Cantor, 1849, Malay. fishes, p. 392.
Chiloscyllium obscurum Gray, 1851, Chondropterygii, p. 35.
Chiloscyllium plagiosum Bleeker, 1852, Plagios., p. 17; Duméril, 1865, Elasm., p. 328; Day, 1865, Fishes Malabar, p. 267.
Chiloscyllium hasseltii Bleeker, 1852, Plagios., p. 19.
Chiloscyllium indicum Günth., 1870, Cat. fishes British mus., **8**, p. 412 (part).
Chiloscyllium indicum Day, 1878, Ind. fishes, p. 726, pl. 188, f. 3.

Elongate, depressed, body cavity five twelfths, head one fifth of the total length. Head rather large, broad posteriorly, narrowed forward, flattened beneath; snout depressed, subacuminate, blunt at the end. Nostrils near the end of the snout, inferior, with a nasoral groove; anterior valves and cirri reaching the teeth, widely separated by the preoral attachments, behind which they present an angle on the free margin; posterior valves forming a fold at the outer side of each nostril, continued in another along the outer side of the nasoral grooves and subcontinuous with the upper labial folds, with a short free extremity at the angles of the mouth. Mouth wide, transverse, nearer to the eye than to the end of the snout, with short labial folds around the angles, on both jaws, and with a transgeneial fold of conspicuous width below the symphysis. Teeth small with sharp triangular median cusps concave on the lateral margins and with broad bases, with or without feeble indications of a lateral cusp at each side of the median. Eye small, in length one fourth of its distance from the end of the snout. Spiracle as large as the eye and more behind than below the orbit, with a prominent fold on the posterior edge. Gill openings narrow, third and fifth widest, fourth and fifth close together, hindmost three above the pectoral. Scales small, carinate, keels converging; when worn smooth the scales have perceptible indications of five to nine keels around the front edge.

Pectorals and ventrals short and broad, subtruncate, angles broadly rounded. Dorsals smaller than the ventrals, second smaller, both much longer than high, hinder angles not produced, hind margins truncate, that of the second more oblique, bases and distance apart equal, more than twice the distance of the second from the origin of the anal; origin of the first dorsal above the middle of the bases of the ventrals. Anal long, little less than the subcaudal.

Olivaceous brown, whitish below the body and head.

Young with about ten transverse bands of light color, and with light spots on the fins.

Described from a female, of about twenty-four inches, from Penang. In the ovaries there is a number of small eggs nearly or quite ready to enter the ducts, while in each of the latter there are two provided with shells, firm and blackish. These shells resemble those of Raiidae more than those of Catulidae. The angles are provided with short blunt processes without tendrils and at the distal end the processes are brought closer together. One edge is longer than the other and more curved; on the inner or shorter edge, near each end there is a mat of long filaments, similar to those of raioids, to serve as anchors. The structure is quite firm being heavily reenforced along the lateral edges.

This species differs from *C. punctatum* in shape of head and snout, in the longer spiracle, in the positions and in the lack of sharpness in the hinder angles of the dorsals, and in the lengths of anal and subcaudal respectively. From *C. griseum* it is distinguished by smaller dorsals, with positions and non production of angles, by the distance of the second dorsal forward from the anal, etc.

India to South Africa and Japan.

Chiloscyllium indicum.

Squalus sp. Gronow, 1754, Mus. **1**, p. 61, no. 133; 1763, Zoophy., **1**, p. 34, no. 150.
Squalus indicus Gmelin, 1789, Linné Syst., **1**, p. 1503; Schneider, 1801, Bloch Ichth., p. 137.
Le squale dentaleé Lacépède, 1798, Poissons, **1**, p. 281, pl. 11, f. 3.
Le squale gronovien Lacépède, 1798, ibid., p. 280.
Squalus tuberculatus Schneider, 1801, Bloch Ichth., p. 137.
Chiloscyllium tuberculatum Müller & Henle, 1841, Plagios., p. 19; Bleeker, 1852, Plagios., p. 20; Duméril, 1865, Elasm., p. 331; Kner, 1867, Nov. fische, p. 412.
Chiloscyllium phymatodes Bleeker, 1852, Plagios., p. 20; Duméril, 1865, Elasm., p. 331.
Squalus caudatus Gray, 1854, Gron. syst., p. 8.
Synchismus tuberculatum Gill, 1861, Ann. N. Y. lyc., **7**, p. 408 (name only).
Chiloscyllium indicum var. δ, ϵ, ζ, Günth, 1870, Cat. fishes Brit. mus., **8**, p. 412–413.
Chiloscyllium indicum Regan, 1908, Proc. Zool. soc. Lond., p. 362, pl. 13, f. 2.

Body slender, cavity little more than one third of the total length; head little more than one sixth, rather narrow, depressed on the crown; snout medium, blunt. Nostrils with nasoral grooves; anterior valves and cirri reaching the mouth, separated by the moderate preoral attachments; posterior valves forming a fold at the outer side of each nostril and continuing in another on the outer side of the nasoral groove, to end in a short free fringed extremity at the angle of the mouth, subcontinuous with the upper labial fold. Mouth small, with short labial folds on both jaws, and with a narrow transgeneial fold behind the symphysis, in front of the lower labial folds. Eye small, elongate, lower lid without a fold. Spiracle small, its front edge below the hind edge of the orbit. Gill openings narrow, hindmost widest, third to fifth above the pectoral, fourth and fifth close together.

Dorsals smaller than the ventrals, equal, hinder margin nearly straight, angles not produced; origin of first dorsal at a vertical from the end of the ventral base; origin of second the length of its base forward of that of the anal, or nearly twice its length backward of the base of the first. Anal narrow, as long as the subcaudal, or longer. Caudals narrow. Claspers short, stout, the outer joints extended beyond the ventral fin. Scales small, with a median keel. A tubercular ridge on the middle of the back from head to tail, broken by the dorsals and a space as long as the orbit in front of each. At each side of this ridge along the upper part of each flank there is most often a less developed ridge. The amount of development in these ridges varies greatly in individuals from the same locality.

Greyish to rusty brown, with narrow streaks or series of brown spots similar in positions to such as might outline the cross bands on *C. plagiosum*. Specimens from Penang are much darker and show larger numbers of spots and intermediate series on the snout and over the body.

Distinguished from *C. plagiosum* by smaller dorsals, longer anal, shorter subcaudal, narrower geneial folds, and the coloration.

Specimens described here are from Penang and Singapore. Adult males measure eighteen inches.

Parascyllium.

Parascyllium Gill, 1861, Ann. N. Y. lyc., **7**, p. 412.

Body long, slender, cavity less than half the total. Head short; snout short, blunt. Nostrils connected with the mouth by nasoral grooves; anterior narial valves with a cirrus, widely separated by the preoral attachment. Mouth with well-developed lower lip; no geneial fold. Teeth small, lanceolate, median cusp longer, lateral cusps small or absent. Gill openings narrow, fourth and fifth close together above the pectoral, fifth widest. Spiracle small, below hinder part of orbit. Fins all small; first dorsal above the space between the ventral and the anal; second behind the anal; subcaudal short, not lobed.

Off coasts of Australia and Tasmania.

Brown, spotted with black on the fins and with white on the body
a darker transverse band on the nape . . . *variolatum* (page 67)
Brown, spotted with black on body and fins
darker cross bands on nape and body . . . *collare* (page 67)

Parascyllium variolatum.

Hemiscyllium variolatum Duméril, 1853, Rev. et mag. zool., p. 121, pl. 3, f. 1; 1865, Elasm., p. 327.
Parascyllium nuchale McCoy, 1874, Ann. mag. nat. hist., ser. 4, **13**, p. 15, pl. 2.
Parascyllium variolatum Gill, 1861, Ann. N. Y. lyc., **7**, p. 413; Regan, 1908, Proc. Zool. soc. Lond., p. 349.

Slender, elongate; caudal region very long; head short; snout short, bluntly rounded. Nostrils large, connected with the mouth by a nasoral groove; anterior valves reaching the lip, widely separated by the preoral attachment, with short cirri. Mouth small, midway from eye to end of snout, with labial folds around the angle, without a geneial fold across the chin. Teeth small, tricuspid, in young. Gill openings small, fourth and fifth close together above the pectoral, fifth widest. Fins small; dorsals subequal, first above middle of space between ventrals and anal, near the total mid length; second little smaller, almost entirely behind the anal; pectorals short and broad; Ventrals entirely forward of the dorsal; end of base of anal little behind origin of second dorsal. Caudal short, narrow, not lobed.

Brown with spots of black. On the type, a young individual, the spots are rather large and distinct in the vertebral series and on the fins; on the body and in a dark band across the nape there are numerous irregular maculae of lighter color.

Type, about 14 inches long, from Australian waters.

Parascyllium collare.

Parascyllium collare Ramsay & Ogilby, 1889, Proc. Linn. soc. N. S. W., ser. 2, **3**, p. 1310; Waite, 1899, Mem. Austr. mus., **4**, p. 32, pl. 2, f. 2; Regan, 1908, Proc. Zool. soc. Lond., p. 349.
Parascyllium variolatum Günth., 1870, Cat. fishes Brit. mus., **8**, p. 410.

In some respects it appears as if this species was founded on adults of the preceding. Hardly any divergence is to be seen in the positions and the sizes of the fins, and the differences in coloration are such as might well be brought about by difference in ages. The individual figured by Waite, 1899, was thirty-three and a quarter inches in length, more than twice the length of the type of *P. variolatum;* according to this author it was yellowish tinged with brown, had eight cross-bands, two of which were situated on the tail, and the under parts were yellow. His figure places the first and more distinct band across the nape, the second behind the pectorals, the third from ventral to ventral, the fourth at the end of the base of the first dorsal, the fifth above the anal, and the sixth at the end of the base of the second dorsal. Between the

nape and the tip of the caudal and on the fins there are spots of black as large as the eye or smaller.

Off Australian coasts; near Port Jackson.

Catulidae.

This family contains small sharks having an anal fin and spiracles and small spineless dorsal fins which are situated behind the body cavity. In one genus (Pentanchus) the first dorsal has disappeared. In all of the species the mouth is large and below the head, the upper lip generally hiding the lower at the angles; the teeth are small, numerous, and acute and there are several series in function; the nictitating membrane is rudimentary, its office being performed by the lower lid, which closes within the upper; the hindmost of the narrow gill openings are above the pectorals; the scales are small and have one to several cusps, the median and its keel usually being sharper; and the eggs are inclosed in horny cases.

Fossil species of Catulidae are found in the Upper Cretaceous and in later formations.

Origin of the first dorsal not in advance of the ventrals
- labial folds on the lower jaw, none on the upper
  - anterior nasal valves with a cirrus
    - ventrals of the male discrete (not concrescent) *Poroderma* (page 69)
  - anterior nasal valves with a rudimentary cirrus
    - ventrals of the male concrescent . . *Catulus* (page 71)
- labial folds absent or rudimentary
  - posterior nasal valves present . . *Cephaloscyllium* (page 78)
- labial folds around the angle of the mouth
  - posterior nasal valve present
    - anal and subcaudal short
      - snout short . . . . . *Halaelurus* (page 81)
    - anal long, subcaudal long; nostrils near the mouth
      - snout short, thick . . . *Parmaturus* (page 88)
  - posterior nasal valve rudimentary, anterior not reaching mouth
    - anal and subcaudal elongate; dorsals small
      - snout elongate, depressed
        - edge of caudal with a special armature *Pristiurus* (page 91)

edge of caudal without special armature
Apristurus (page 96)
anal and subcaudal elongate; only one dorsal fin
Pentanchus (page 95)
posterior nasal valve absent, anterior reaching mouth
anal and subcaudal short, dorsals larger
snout short, narrow; a fold below the eye
Atelomycterus (page 100)
anal and subcaudal short, anal larger than dorsals
snout short, depressed; no fold below the eye
Haploblepharus (page 101)
Origin of first dorsal slightly in advance of ventral origins
labial folds short, upper longer
anal long, distant from the subcaudal
snout elongate . . . . *Proscyllium* (page 102)

Poroderma.

Poroderma A. Smith, 1837, Proc. Zool. soc. Lond., p. 85.

Body rather stout, cavity more than half the total length. Head less than one fourth of the total; snout short, longer than the mouth, depressed, blunt. Nostrils without a nasoral groove; anterior valves short, widely separated, not reaching the mouth, with a strong cirrus; posterior valves broad, short. Eyes small; lower lid with a very slight fold. Mouth wide, short; teeth small, tricuspid. Labial folds at the angles of the mouth, on the lower jaws only. Spiracles moderate, behind the eyes, not distant. Ventrals short. Scales small, tricuspid, median cusp elongate, acute. First dorsal fin behind the ventrals; second dorsal smaller than either first or anal. Gill openings medium, hindmost above the pectoral, narrow.

Off the coasts of southern Africa.

The species are distinguished almost entirely by differences in their markings; they are separated as follows:

Marked by longitudinal stripes, nearly or quite unspotted
nasal cirrus usually not reaching the edge of the lip . *africanum* (page 70)
Marked by spots, rings or vermiculations, spots sometimes confluent
nasal cirrus longer, reaching the edge of the lip or beyond
pantherinum (page 70)

Poroderma africanum.

Le Galonné Broussonet, 1780, Mém. Acad. roy., p. 659.
Squalus fasciatus Bonnaterre, 1788, Ichth, p. 8.
Squalus africanus Gmelin, 1789, Linné, Syst., **1**, p. 1494.
Squalus vittatus Shaw & Nodder, 1798, Nat. misc., **9**, pl. 346.
Scyllium africanum Cuv., 1817, Reg. anim., **2**, p. 124; 1829, **2**, p. 386; Müller & Henle, 1841, Plagios., p. 12, pl. 7, f. ; A. Smith, 1849, Afr. Pisces, pl. 25, f. 1; Duméril, 1865, Elasm., p. 321; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 405; p. 406 "var. a. *africana* s. *striata*."
Poroderma africanum A. Smith, 1837, Proc. Zool. soc. Lond., p. 85.
Squalus striatus Forster, 1844, Descrip. anim., ed. Lichtenstein, p. 407.
Scyliorhinus africanus Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 456.
Lui haai, *Lazy shark*, local names.

Snout short, narrowed toward and rounded at the end. Nasal cirrus rather short, in most cases not reaching the lip. The first dorsal appears to be larger than the ventrals, its origin is placed closer to a vertical from the ends of their bases, and the difference in size between this dorsal and the second dorsal is perhaps a trifle greater than in the species *P. pantherinum*. Like that species this one is subject to great variations in markings. As figured by Smith individuals of *P. africanum* have five or seven longitudinal bands each of which, between the head and the caudal region, divides into two narrow stripes while the lower one on each side breaks into spots or short bars behind the ventrals. On the cheek in front of the gill apertures there are some small spots. Other descriptions give five or seven bands along the upper parts each band sometimes lighter in the middle. Reaches a length of three feet or more.

Types described from Algoa Bay and the Cape.

Poroderma pantherinum.

Poroderma pantherinum A. Smith, 1837, Proc. Zool. soc. Lond., p. 85.
Poroderma variegatum A. Smith, 1837, ibid.
Poroderma submaculatum A. Smith, 1837, ibid.
Scyllium pantherinum Müller & Henle, 1841, Plagios., p. 13, pl. 7, f.; A. Smith, 1849, Afr. Pisces, pl. 25, f. 3; Duméril, 1865, Elasm., p. 322.
Scyllium africanum var. *variegatum* Günth., 1870, Cat. fishes Brit. mus., **8**, p. 406.
Scyllium africanum var. *pantherinum* Günth., 1870, ibid.
Scyliorhinus pantherinus Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 456.

Snout short, blunt, rounded at the end. Nasal cirrus reaching the lip or beyond it. Origin of the first dorsal a short distance behind a vertical from the bases of the ventrals; base of first dorsal nearly two thirds, and base of second dorsal less than half the length of the anal base. One third or more of the base of the second dorsal lies behind that of the anal. Pectorals nearly as broad as long, subtruncate.

Greyish to brownish, with brown markings. Smith says fresh specimens

have, on the head, the back, the sides superiorly, and the tops of the pectorals, a tint intermediate between lavender-purple and brownish purple-red, the dorsals and pectorals stronger in the reddish or flesh color, and on the lower surfaces generally and the caudal a yellowish gray faintly tinted with flesh-red. The variety *pantherinum* is marked by spots and rings or enclosures; var. *variegatum* by spots and longitudinal streaks. An individual from the Cape shows the brown rings placed nearly in longitudinal as also to some extent in transverse rows. It exhibits many of the rings divided into two, each of which is open toward the other. All stages of this division are to be seen; whether it is made more often vertically or longitudinally is undecided. Many of the halves resemble the letter C. On Smith's figure of *P. variegatum* the spots are small, numerous, and in some measure arranged longitudinally. Above the middle of the flank they tend to form two long stripes; the fins are immaculate. The figure of *P. pantherinum* has the fins and the head sprinkled with small maculae and the body is closely marked by brown rings or enclosures of no regularity in positions or shapes. Reaches three feet or more in length.

South Africa.

CATULUS.

Catulus VALMONT, 1768, Dict. hist. nat., **4**, p. 51; A. SMITH, 1837, Proc. Zool. soc. Lond., p. 85 (part).
Scyliorhinus BLAINV., 1816, Bull. Soc. phil., p. 121 (part).
Scyllium CUV., 1817, Reg. anim., **2**, p. 124 (part).

Body shorter than the tail; head and caudal short; snout short, blunt. Nostrils distinct from the mouth, or, in the species in which the posterior nasal valve is cirroid, with a rudimentary nasoral groove. Anterior nasal valves not confluent across the internarial space, cirri absent or rudimentary. Spiracles small, close to the corner of the eye. Mouth large; a labial fold on the lower jaw. Teeth in numerous rows, each tooth with a median larger cusp and one to several small lateral cusps. Gill openings small, hindmost above the pectoral. Dorsals and anal small, anal the largest; caudal short. First dorsal above or behind the bases of the ventrals. Ventrals of the male more or less concrescent above the claspers. Fossil species from the Cretaceous and later.

Atlantic, Pacific, and Indian Oceans.

Anterior nasal valves reaching the mouth
  posterior nasal valves cirroid; a shallow nasoral groove
    first dorsal behind ends of ventrals bases
      second dorsal partly above the base of the anal

caniculus (page 72)

second dorsal wholly behind base of anal
length of anal base about equal its distance from the caudal
duhamelii (page 73)
length of anal base less than its distance from caudal
capensis (page 74)

posterior nasal valves not cirroid
first dorsal at ends of ventrals
second dorsal base with half its length behind the anal base
marked by scattered spots as large as the eye, larger and smaller . . . . . *stellaris* (page 57)

Anterior nasal valves not reaching the mouth
posterior nasal valves broad, not cirroid
first dorsal behind the ends of the ventrals
second dorsal small, mainly behind the anal
marked by a network of brown . . *retifer* (page 76)
marked by transverse series of blotches of brown and of whitish *boa* (page 77)
first dorsal at the ends of the ventrals; snout short
second dorsal small, at the end of the anal
marked by transverse blotches of brown and by spots of whitish . . . . . *torazame* (page 77)
first dorsal ending above the ventrals
second dorsal small, half its base behind that of the anal
uniform brown . . . . . *cephalus* (page 78)

Catulus canicula.

Galeus stellaris major Belon, 1553, Aquat., p. 73.
Catulus minor Salviani, 1554, Aquat., fol. 137, 138, fig. 46; Aldrovandi, 1613, Pisc. & Cet., p. 390; Will., 1686, Pisc., p. 64, pl. B4, no. 2; Jonst., 1649, Pisc., p. 25, pl. 8, f. 2.
Canicula aristotelis Rondelet, 1554, Pisc., p. 380; Gesner, 1558, Aquat., p. 198.
Catulus major vulgaris Ray, 1713, Pisc., p. 22; Valmont, 1768, Dict. hist. nat., **4**, p. 51.
Squalus sp. Artedi, 1738, Ichthyologia, Gen., p. 68, 69, no. 10–11; Gronow, 1756, Mus. **2**, p. 44, no. 199; 1763, Zoophy., **1**, p. 32, no. 144.
Squalus canicula Linné, 1758, Syst., **1**, p. 234; Bonnaterre, 1788, Ichth., p. 6; Gmelin, 1789, Linné Syst., **1**, p. 1490; Risso, 1826, Hist. nat., **3**, Poissons, p. 116.
Squalus catulus Linné, 1758, Syst., **1**, p. 235; Brunnich, 1768, Ichth. Massiliensis, p. 5; Bloch, 1785, Ausl. fische, **1**, p. 21, pl. 114; Gmelin, 1789, Linné Syst., **1**, p. 1490; Schn., 1801, Bloch Ichth., p. 127; Donovan, 1804, Br. fish., pl. 55; Risso, 1810, Ichth. Nice, p. 29; Gray, 1851, Chondropterygii, p. 29; 1854, Gron. syst., p. 5.
Lesser dog fish Pennant, 1769, Zool., **3**, p. 90.
Catulus stellaris major Duhamel, 1777, Traité, **3**, sect. ix, p. 304, pl. 22, f. 1.
Le squale rochier Lacépède, 1798, Poiss., **1**, p. 233, pl. 10, f. 1.
Galeus caniculus Rafinesque, 1810, Ind. itt. Sic., p. 46.

Scyliorhinus caniculus Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 71, pl. 17, f. 1; Jensen, 1907, Dan. fiske, p. 301, pl. 27, f. 3; Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 458.
Scyllium canicula Cuv., 1817, Reg. anim., **2**, p. 124; Parnell, 1838, Mem. Wern. soc., **7**, p. 407; Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 48, f. 1; Müller & Henle, 1841, Plagios., p. 6, pl. 7; Kröyer, 1853, Danm. fiske, **3**, p. 814; Nilsson, 1855, Fisk. Skand., p. 711; Duméril, 1865, Elasm., p. 315; Bocage & Capello, 1866, Plagios., p. 11; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 402; Canestrini, 1872, Ital. pesci, p. 50; Malm, 1877, Göteb. och Bohus. fauna, p. 619; Winther, 1879, Prodr., p. 57; Collett, 1875, Norges fiske, p. 210; Moreau, 1881, Poiss. France, **1**, p. 278; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 24; Day, 1884, Brit. fishes, **2**, p. 309, pl. 159, f. 1.
Scylliorhinus catulus Blainv., 1830, Poiss. Fr., p. 69, pl. 17, f. 1.
Scylliorhinus elegans Blainv., ibid., p. 73.
Rough hound Couch, 1867, Brit. fishes, **1**, p. 14, pl. 2.

Snout short, broadly rounded. Nostrils nearer to the mouth than to the end of the snout. Anterior nasal valves reaching the mouth in a broad flap in which they are narrowly separated at their point of attachment in front of the symphyses of the jaws; a very rudimentary cirrus on each valve. Posterior nasal valve a narrow short cirroid. A shallow nasoral groove. Mouth wide, much curved; upper lips concealing the lower at the angles; a labial fold at the angles, on the lower jaw, extending half way to the symphysis. Eyes moderate; edge of lower lid closing within the upper. Spiracle small, near the corner of the eye. Gill openings small, hindmost two above the base of the pectoral. Dorsals small; origin of the first dorsal a short distance farther back than the ends of the bases of the ventrals; second dorsal smaller, origin above the hindmost fourth of the base of the anal. Base of the anal one and two thirds times as long as that of the first dorsal; tip of the fin ending below the middle of the base of the second dorsal or farther back. Ventrals very oblique, those of the male joined above the claspers and more produced. The base of the anal is longer than its distance from the caudal and it subtends one fourth to one half of the forward portion of the base of the second dorsal.

Light rusty or reddish brown thickly sprinkled with small spots of brown, smaller than the eye to mere dots, on back and flanks, larger and more widely scattered on the fins and on the lower flanks.

Among the specimens examined, males of eighteen inches were immature, and those of about two feet in length appeared to be quite mature and had claspers fully developed. In the small variety usually confused with this, *C. duhamelii*, described below, the male is mature at a length of thirteen inches.

Mediterranean and Atlantic; off the coasts of Europe.

Catulus duhamelii, sp. nov.

Catulus saxatilis Duhamel, 1777, Traité **3**, sect. 9, p. 304, pl. 22, f. 2–3.
Petite roussette ou *Chat rochier* Duhamel, 1777, loc. cit.

Snout short, longer than the mouth, broadly rounded at the end. Nostrils nearer to the mouth than to the end of the snout. Anterior nasal valves broad, reaching the mouth, narrowly separated from one another at their median attachment; posterior valves narrow, cirroid. A labial fold on the lower jaw, extending half way to the symphysis. Upper lip closing outside of the lower at the angles. Eye medium; lower lid closing inside the upper. Teeth very small, with three to five cusps, median longest; six rows at the symphysis of the lower jaws of much smaller teeth. Spiracle small, close to the angle of the eye. Gill openings moderate, anterior widest, hindmost smaller and above the pectoral. Dorsal fins small, first larger and originating a short distance behind the ends of the bases of the ventrals; origin of the second dorsal at the end of the base of the anal. Anal base twice the length of the base of the first dorsal, longer than its own distance from the caudal. Subcaudal short, its basal length nearly one and one half times that of the anal.

Back and fins with diffused or indefinite spots and blotches of brown varying greatly in depth of color, especially toward the back, where they are darker more or less fused and intermixed with others of white.

Description from a female of 17 inches, from the Adriatic, and from a fully mature male of 13½ inches, from Nice.

Distinguished from *Catulus caniculus* by the positions of the dorsals and by the markings, and from *C. stellaris* by the positions of the dorsals, the markings, and a narrower separation of the nasal valves on the internarial space at the mouth. It is the smaller southern race of *C. caniculus*.

Mediterranean Sea and Atlantic coasts of Europe.

Catulus capensis.

Scyllium capense A. Smith, 1837, Proc. Zool. soc. Lond., p. 85; Müller & Henle, 1841, Plagios., p. 11; Duméril, 1865, Elasm., p. 320; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 404; Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 458.

Snout short, blunt. Anterior nasal valve reaching the mouth, broad, with a moderate attachment or median separation in front of the symphyses; a rudimentary cirrus. Labial fold short, on the lower jaw. Teeth small with one to two lateral denticles more or less distinct. Hindmost gill opening above the pectoral. First dorsal above the space between the ventrals and the anal, nearer to the former. Origin of second dorsal a little forward of the hind end of the base of the anal, fin smaller than that of the first dorsal. Base of the anal nearly twice as long as that of the second dorsal, length less than the distance from the caudal. Scales small, tricuspid.

Back with alternating light cross-bands and darker ones with whitish spots. Lower surfaces uniform light. A longer species than the preceding, more closely allied to *C. caniculus*. The types of the species were 24–41 inches in length.

Off the coasts of southern Africa.

Catulus stellaris.

Galeus stellaris, minor Belon, 1553, Aquat., p. 74.
Catulus maior Salviani, 1554, Aquat., fol. 138, pl. 45; Will., 1686, Pisc., p. 62, pl. B4, f. 1.
Canicula saxatilis Rondelet, 1554, Pisc., p. 383; Gesner, 1558, Aquat., **4**, p. 199.
Catulus maximus Will., 1686, Pisc., p. 63; Ray, 1713, Pisc., p. 22.
Squalus stellaris Linné, 1758, Syst., **1**, p. 235; 1766, Syst., **1**, p. 399; Gmelin, 1789, Linné Syst., **1**, p. 1491; Risso, 1810, Ichth. Nice, p. 31; 1826, Hist. nat. **3**, Poissons, p. 116.
Catulus saxatilis Valmont, 1768, Dict. hist. nat., **4**, p. 51.
Greater dog fish Pennant, 1769, Zool., **3**, p. 88.
Le chat rochier Broussonet, 1780, Mem. Acad. roy., p. 651.
Squalus canicula Bloch, 1785, Ausl. fische, **1**, p. 16, pl. 112; Bonnaterre, 1788, Ichth., pl. 6, f. 17.
Le squale roussette Lacépède, 1798, Poissons, **1**, pl. 9, f. 2.
Galeus stellaris Rafinesque, 1810, Ind. itt. Sic., p. 46.
Scyllium catulus Cuv., 1817, Reg. anim., **2**, p. 124; Parnell, 1838, Mem. Wern. soc., **7**, p. 410; Müller & Henle, 1841, Plagios., p. 7; Duméril, 1865, Elasm., p. 316; Bocage & Capello, 1866, Plagios., p. 11; Coste, 1867, Compt. rend. Acad. sci., p. 99; 1867, Ann. mag. nat. hist., ser. 3, **19**, p. 227; Moreau, 1881, Poiss. France, **1**, p. 280; Day, 1884, Brit. fishes, **2**, p. 312, pl. 159, f. 2.
Scyllium stellare Fleming, 1828, Brit. anim., p. 165; Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 48, f. 2; Thompson, 1856, Nat. hist. Ireland, **4**, p. 247; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 402; Malm, 1877, Göteb. och Bohus. fauna, p. 622.
Scylliorhinus stellaris Blainv., 1830, Poiss. Fr., p. 71, pl. 17, f. 2; Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 457.
Nurse hound Couch, 1867, Brit. fishes, **1**, p. 11, pl. 1.

Snout short, little longer than the mouth, broadly rounded in front. Nostrils little nearer to the mouth than to the end of the snout. Anterior nasal valves short, reaching the mouth, broad, with a rather wide space half the width of each valve between them at the lip, and with a prominent rudiment of a cirrus on the middle of each; posterior valves small, short, broad, not cirroid. Width of mouth twice the length; a short labial fold on the lower jaw, not reaching half way to the symphysis. Eye medium; edge of lower lid closing within the upper. Gill openings narrow; hindmost two very small, above the pectoral. Spiracle small, close to the corner of the eye.

Dorsals small; anterior dorsal larger, origin little in front of the hinder ends of the bases of the ventrals. Base of second dorsal small, two thirds as long as the interdorsal space, half of its length extended forward above that of the anal. Base of anal less than twice as long as that of the second dorsal; lower margin of the fin broadly rounded. Subcaudal short, base less than four times the greatest depth, or less than twice the length of the anal base. Ventrals of the male united above the claspers. Scales small, rough, with three cusps, median largest.

Reddish or rusty brown with spots and scattered blotches of brown, ranging in size from small to as large as the eye, or larger, and larger on the flanks; fins maculate. Lower surfaces whitish.

Young individuals, of six inches in length, have two rows of larger scales on the back, extending from the nape to points opposite the first dorsal and separated from one another by about ten rows of the smaller scales. In these enlarged scales the median cusp is lengthened and broadened and the laterae cusps are small or absent at one side of the median. Specimens of this size are rough and have seven or eight broad transverse bands of brownish on back and flanks in addition to the darker spots. Tips of fins lighter. On one specimen four of the bands are behind the vent; one band crosses on the nape another between the pectorals a third in front of the dorsal, two others through the dorsals and two across the caudal fins.

Mediterranean and Eastern Atlantic to the North Sea.

Catulus retifer.

Scyllium retiferum Garman, 1881, Bull. M. C. Z., **8**, p. 233.
Scylliorhinus retifer Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 869; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 25; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 16, pl. 4, f. 14, 15; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 457.

Body cavity nearly half of the total length. Snout depressed, blunt, length about equal to width of mouth. Nostrils much nearer to the mouth than to the end of the snout; anterior valves not reaching to the mouth, widely separated on the internarial space, with an indistinct rudiment of a cirrus; posterior valves short. Length of mouth two thirds of the width, lower lip with a fold at the angle reaching about one fourth of the distance to the symphysis. Eye moderate; lower lid apparently translucent or transparent, closing inside of the upper. Spiracle very small, close to the corner of the eye. Gill openings small, hindmost two above the bases of the pectorals. Dorsals small; first dorsal origin at a very short distance behind the ends of the bases of the ventrals, tip reaching the origin of the anal; second dorsal half as large as the first, origin above the posterior fourth of the base of the anal, nearly two thirds of the base extending behind that of the anal. Subcaudal short, narrow, widest at mid length. Ventrals of males partly united above the claspers. Scales small, with three to five keels.

Light brown or reddish brown, crossed at irregular intervals by groups of two to four narrow black lines which are joined, toward the flanks, by short lines in such a manner as to enclose polygonal areas, thus forming a network in

which the meshes vary exceedingly in size and shape. Uniform light yellowish below. The first mesh of the network crosses the nape and passes backward to the first gill opening; the second crosses the ends of the bases and the third goes above the tips of the pectorals; the fourth mesh is over the origins of the ventrals; the fifth at the origin and the sixth at the end of the base of the first dorsal; the seventh and the eighth are similarly placed in regard to the second dorsal; and the eighth is at the origin and the ninth in the middle of the caudal.

Specimen twelve inches in length, taken off the coast of Delaware, in a depth of 89 fathoms, Lat. 38° 22′ 05″ N.; Long. 73° 33′ 40″ W.

Catulus boa.

Scylliorhinus boa Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 17 (name only).
Scylliorhinus retifer Goode & Bean, 1896, ibid., pl. 2, f. 6.
Catulus retifer var. *boa* Ribeiro, 1904, Bol. Soc. nac. agric., p. 17.
Catulus haeckelii Ribeiro, 1907, Arch. Mus. nac., **14**, p. 163, pl. 8.
Scyliorhinus retifer var. *boa* Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 457.

Rather closely allied to *Catulus retifer* in many respects. The specimen in hand is the type; it was that examined by Goode and Bean who had it figured (*loc. cit.*) as *Scylliorhinus retifer*. Their figure does not show all of the markings, is not exact in the shape of the tail, and differs from the type in other respects. The figure published by Ribeiro as *Catulus haeckelii* (*loc. cit.*) gives a much better representation of *C. boa*. The transverse blotches of *C. boa* would be somewhat nearly outlined in the network of *C. retifer*, but the latter is without spots while the former has dark spots and blotches as shown in the figure of *C. haeckelii*, and also has spots of white scattered over the back and the flanks which may not appear in individuals of greater age.

The markings can be depended on to distinguish *C. boa* from *C. retifer*.

The type of the latter was taken off Barbados in water of 200 fathoms in depth; it measures six inches in total length. The type described as *C. haeckelii* is the more spotted and was 13 inches long; it was taken off Rio Janeiro in about 43 fathoms, giving the known range of *C. boa* from the West Indies to southern Brazil.

Catulus torazame.

Catulus torazame Tanaka, 15 March, 1908, Journ. Coll. sci., Tokyo, **23**, p. 6, pl. 2, f. 2.
Scyliorhinus rudis Pietschmann, 19 March, 1908, Anz. Akad. wiss. Wien, **10**, p. 2; 1908, Sitzb. Akad. wiss. Wien, **117**, p. 699, pl. 1, f. 3; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 457.
Halaelurus rudis Tanaka, 1911, Fishes of Japan, **1**, p. 13, f. 12.
Halaelurus torazame Tanaka, 1912, Fishes of Japan, **5**, p. 87.

Body cavity nearly half of the total length. Snout short, little longer than the mouth, narrowed and rounded at the end. Nostrils nearer to the mouth

than to the end of the snout; anterior valves not reaching the mouth, broad, widely separated on the internarial space; posterior valves shorter. Mouth large, its width more than twice its length; a short labial fold on the lower jaw. Dorsals small; first nearly equal the anal, origin above the ends of the bases of the ventrals; second dorsal much smaller, origin behind the middle of the base of the anal. Subcaudal short, base nearly twice as long as the base of the anal. Scales rough, with one to three sharp cusps, a median keel and diverging striae. A small species the males of which mature at about twenty inches in length.

Brown or greyish brown with nine or ten large irregular subquadrate blotches of darker across the back and the sides, and (on young) with scattered spots of whitish over ground color and blotches. Lower surfaces light, plain.

Misaki, Japan.

Catulus cephalus.

Catulus cephalus Gilbert, 1891, Proc. U. S. nat. mus., **14**, p. 541; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 24.
Scyliorhinus cephalus Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 460.

A small species from deep waters, taken off the Revillagigedo Islands in 460 fathoms, and in the Gulf of California at 362 fathoms. The description does not include the nasal valves, the labial folds, the eyes, etc., consequently the position of the species is not at all certain. It is placed here provisionally.

Head wider and snout shorter than in *Parmaturus xaniurus*. Length of snout less than half its greatest width. The dorsals are the larger, the anal is the smaller, nearly equal the second dorsal and ending slightly in front of it. The first dorsal terminates above the ventrals instead of behind them. The position of the second dorsal is said to agree with that of *Halaelurus canescens*, that is its origin is nearly above the middle of the base of the anal. Males of about ten inches in length were nearly mature.

Uniform brown, above and below.

Cephaloscyllium.

Scyliorhinus Blain., 1816, Bull. Soc. philom., p. 121 (part).
Cephaloscyllium Gill, 1861, Ann. N. Y. lyc., **7**, p. 412.

Body robust, longer than the tail. Head broad, depressed. Snout short, blunt, narrowing rapidly forward. Nostrils distant from one another, near the lip, nearer to the end of the snout than to the angles of the mouth; no nasoral groove; valves not extended on the internarial space, without cirri, posterior

short and joined to the anterior at the inner ends. Mouth wide, greatly arched, distensible, labial folds rudimentary. Teeth small, numerous, with three to five cusps, median cusp longest. Eye lateral, orbit elongate, lower lid included by the upper in closing. Spiracle behind the eye. Hindmost gill openings above the pectoral. Dorsal behind the ventral origins. Second dorsal smaller than the first and smaller than the anal.

Eastern Pacific to New Zealand and Australia and Japan.

Band across the head extended from eyes to hindmost gill openings
anal fin a little longer than the dorsal
lower surfaces yellow . . . . . *isabellum* (page 79)
Band across the head not reaching from eye to gill openings
interdorsal space not longer than base of first dorsal
body with transverse bands and with spots; teeth small
fins with blotches of dark on each side *ventriosum* (page 80)
Band across the head obsolete; teeth minute
interdorsal space longer than base of first dorsal
body marbled and blotched with darker
fins nearly uniform . . . . *umbratile* (page 80)

Cephaloscyllium isabellum.

L'Isabelle Broussonet, 1780, Mém. Acad. roy., p. 648.
Squalus isabella Bonnaterre, 1788, Ichth., p. 6; Walbaum, 1792, Artedi, p. 514; Donndorf, 1798, Zool. beytr., **3**, p. 836.
Squalus sabella Gmelin, 1789, Linné Syst., **1**, p. 1489; Waite, 1910, Trans. N. Z. inst., **42**, p. 384.
Scyliorhinus isabellus Blainv., 1816, Bull. Soc. philom., p. 121.
Scyllium laticeps Duméril, 1853, Rev. et mag. zool., **34**, p. 84, pl. 3, f. 2; 1865, Elasm., p. 323; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 404.
Cephaloscyllium laticeps Gill, 1861, Ann. N. Y. lyc., **7**, p. 408 (name only).
Scyliorhinus laticeps Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 458.

Body robust, somewhat depressed. Head short, broad. Snout short, blunt. Nostrils large, anterior valves without cirri; far apart, not connected with the mouth. A fold below the eye; orbit elongate. Mouth wide, much arched. Teeth compressed, short, triangular, sharp, with a denticle at each side of the base. Spiracles large, behind the eye. Two gill openings above the pectoral. Pectorals large, subquadrangular, hind margin nearly straight. Dorsals quadrangular; origin of the first dorsal above the vent; second smaller, above the anal fin. Subcaudal of moderate depth, separated from the terminal by a notch. Length about two feet eight inches.

Brown, ashy reddish to yellowish, irregularly spotted and blotched with

darker on the sides; lower surfaces yellowish. Top of head dark, with a broad yellowish cross band, extending behind the eye to the gill openings.

Australia to New Zealand.

Cephaloscyllium ventriosum.

Plate **9**, fig. 6–9.

Scyllium ventriosum Garman, 1880, Bull. M. C. Z., **6**, p. 167; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 59.
Catulus (*Cephaloscyllium*) *uter* Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 25; 1900, ibid., Atlas, pl. 3, f. 12.
Scyliorhinus ventriosus Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 458.

Body robust, more than half of the total length. Head broad. Snout short, blunt, narrowed forward, subangular. Nostrils near the lip, distinct from the mouth and far apart; valves not extended on the internarial space, short, blunt, without cirri. Mouth wide, greatly arched. Teeth three to five cusped, broad based, excepting the symphyseal which are lanceolate, in $\frac{53}{52}$, $\frac{57}{50}$ and $\frac{67}{58}$ rows. Spiracle small, near the eye. Gill openings small, two above each pectoral. Outer angle of pectorals blunt, outer angles of the other fins broadly rounded. Origin of first dorsal behind the middle of the total length, above or slightly in front of the middle of the bases of the ventrals, distance from the second dorsal varying in different individuals. Second dorsal smaller than the anal and opposed to it. Anal smaller than first dorsal, bases about equal, commonly about one and one fourth times the length of the base of the second dorsal. Largest individuals at hand measuring two feet six inches in length.

Greyish brown to brown, spotted and transversely banded with darker. The bands are irregular, not always present; in cases there are about twelve: the first across the snout, the second across the crown and eyes, and five or six occur between the eyes and the dorsal. The lower surface is dark and the spots are indistinct. A large blotch of darker appears on each side of each of the fins.

Specimens from California differ from the type (from Chile) mainly in being somewhat darker.

Cephaloscyllium umbratile.

Scyllium laticeps Nyström, 1887, K. Svensk. vet. akad. handl., **13**, p. 49; Ishikawa & Matsuura, 1897, Cat. fishes, p. 62.
Cephaloscyllium umbratile Jord. & Fowler, 190?, Proc. U. S. nat. mus., **26**, p. 602, f. 1.
Scyliorhinus umbratilis Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 459.

Body robust, broad and depressed. Head large, wide behind the eyes, small, triangular, and flattened in front. Snout short, blunted at the end.

Nostrils large, far apart, much nearer to the end of the snout than to the angles of the mouth; anterior valve broad, produced at the outer angle, not reaching the lip. Mouth very large, half as long as wide, straight on each side and broadly rounded in front, capable of much enlargement, the jaws being loosely joined at the symphyses; labial folds quite rudimentary, a small rounded upper-lip overhanging each angle. Orbit elongate; lower eyelid included by the upper when closed. Teeth minute, tricuspid; cusps conical at the apex, striate near the bases; rows $\frac{118}{124}$. Spiracle very small, close behind the eye. Gill openings moderate, width equal preoral length of snout, or length of orbit. Pectorals large, as broad as long, angles rounded, hind margin nearly straight. First dorsal much smaller than the pectoral, base little longer than the interdorsal space, origin above front edge of vent, hind margin truncate, upper angle rounded, hinder of 90°. Second dorsal small, base equal two thirds of that of the first dorsal, equal the distance from the caudal, base above the hinder two thirds of the base of the anal, upper angle broadly rounded, hinder produced and ending opposite that of the anal. Anal nearly as large as the first dorsal, much larger than the second, hind angle produced, length of base equal two thirds of its distance from the caudal. Caudal about one fifth of the total length, moderately deep; subcaudal portion with a feeble rounded production or lobe; terminal subtruncate, a notch at its lower edge. Total length 39, snout to abdominal pores 22, snout to dorsal 21, snout to pectoral $8\frac{1}{2}$, snout to mouth $1\frac{1}{2}$, and caudal $8\frac{1}{2}$ inches.

Rusty brown irregularly and profusely spotted and clouded with darker, on upper and lower surfaces; little lighter below. A yellowish band crosses the head between the eyes and is followed by a band of dark on the occiput, an indefinite cross band of dark passes through the bases of the pectorals, another behind them across the middle of the body, another through each dorsal, and one through the forepart of the caudal and one through its middle.

Japan. Alan Owston collection.

Halaelurus.

Halaelurus Gill, 1861, Ann. N. Y. lyc., **7**, p. 407, 412.

Body short, caudal section longer. Head short, depressed; snout short. Nostrils with two valves; anterior not reaching the mouth, widely separated across the internarial space; cirrus absent or rudimentary. No nasoral groove. Mouth large, with a labial fold on each jaw around the angles. Teeth small, numerous, with three to five cusps, rarely without lateral cusps. Spiracle small,

near the corner of the eye. Gill openings narrow, hindmost two above the pectoral. Fins all small, pectoral short, broad. Origin of the first dorsal behind the origins of the ventrals; origin of second dorsal farther back than that of the anal. Anal short; subcaudal short.

Southeastern Pacific and Australia to the Arabian Sea, India, and Japan.

First dorsal and second about equal
- origin of first dorsal above the middle of the bases of the ventrals
  - anal base little longer than base of second dorsal
    - transverse bands of darker spotted with black *bürgeri* (page 83)
  - anal base one and one half times that of the dorsal
    - transverse blotches or cross bands and faint spots of darker *chilensis* (page 83)
- origin of first dorsal above hinder third of bases of ventrals
  - anal base one and one half times that of second dorsal
    - transverse bands broad, with marblings and reticulations *natalensis* (page 84)
- origin of first dorsal little in advance of hind ends of ventral bases
  - anal base little longer than either dorsal base
    - transverse bands narrow, 20 or more, separated by light *quagga* (page 84)

First dorsal larger than second
- origin of first dorsal little forward of ends of ventral bases
  - grey, dull, uniform . . . . . *hispidus* (page 85)
- origin of first dorsal above hind ends of ventral bases
  - brown with scattered small spots of darker . *analis* (page 85)

First dorsal smaller than second
- origin of first dorsal at ends of first two thirds of ventrals bases
  - brown with faint cross bands and spots of darker and lighter *bivius* (page 86)
- origin of first dorsal above middles of ventral bases
  - blackish, uniform; scales simple . . . *alcockii* (page 87)
  - greyish, caudal tipped with black other fins with white *canescens* (page 87)

First dorsal base little if any shorter than anal base
- origin of first dorsal above hind edge of vent
  - brown, dark, with scattered small spots of black *labiosus* (page 88)

Halaelurus bürgeri.

Scyllium bürgeri Müller & Henle, 1841, Plagios, p. 8, pl. 2; Schlegel, 1850, Jap. Pisces, p. 301; Bleeker, 1856, Act. Soc. sci., Ind. Neerl., I, Amboina, p. 69; Duméril, 1865, Elasm., p. 320; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 404.

Halaelurus bürgeri Gill, 1861, Ann. N. Y. lyc., **7**, p. 412 (name only); Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 601.

Scyliorhinus buergeri Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 461.

Snout short, blunt, depressed. Nostrils nearly midway from the mouth to the end of the snout. Anterior nasal valves not reaching the mouth, widely separated from one another on the internarial space. Mouth large; labial folds short, around the angles. Teeth small, with three to five cusps. Pectorals short, broad. Origin of the first dorsal above the middle of the bases of the ventrals. Hind margins of the ventrals very oblique. Dorsals equal. Origin of the second dorsal above the hinder end of the base of the anal. Length of the base of the anal about half the distance from the caudal, little greater than the basal length of the second dorsal. Subcaudal short, narrow.

Brown, with darker transverse bands, with scattered spots of black. Lower surfaces lighter, uniform.

Japan to the East Indies.

Halaelurus chilensis.

Scyllium chilense Guichenot, 1848, Fauna Chilena, **2**, p. 362; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 405; 1880, Challenger rept. Zool., **1**, p. 19; Perez, 1886, Estud., p. 9; Philippi, 1887, Ann. Univ. Chile, **71**, p. 556, pl. 7, f. 4.

Scylliorhinus chilensis Smitt, 1898, Bih. kon. Svenske vet.-akad. Handl., **24**, p. 72 (part); Delfin, 1901, Cat. peces Chile, p. 15 (part); Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 462.

Body shorter than the tail. Head short, broad, depressed; snout very short, length less than half the width of the mouth. Eye small. Spiracles small near the corner of the eye. Nostrils near the mouth; anterior nasal valves short, broad, widely separated from one another, notched on the posterior margin, cirrus rudimentary; posterior valves shorter, broad. Mouth large, near three times as wide as long, with labial folds around the angle; lower fold half as long as the jaw, upper shorter. Teeth small, median cusp strongest. Gill openings medium, hindmost two above the pectoral. Dorsals subequal; origin of the first dorsal above the middles of the bases of the ventrals, two thirds of the base extended behind their ends; origin of second dorsal at the end of the anterior three fourths of the anal, and nearly two thirds of the base reaching behind that of the same fin. Depth of the anal one half of that of the first dorsal, length of base one and one half times the dorsal base, or two thirds

of the distance from the caudal. Ventrals rather short. Caudal fins small. Scales small, tricuspid to granular, median cusp and keel strong, some larger granules on each side near the median line of the back.

Brownish with faint spots of darker, and with larger blotches or cross bands on the back.

Valparaiso; Patagonia.

Halaelurus natalensis.

Scyllium natalense Regan, 1904, Ann. & mag. nat. hist., ser. 7, **14**, p. 128.
Scyliorhinus natalensis Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 461.

Head broad, depressed; snout obtusely pointed. Mouth with labial folds around the angle, extending on two fifths of the lower jaw and less than one fifth on the upper. Teeth tricuspid, middle cusp longest. Dorsals subequal, length of base about two fifths of their distance apart. Origin of first dorsal above the posterior third of the bases of the ventrals; origin of second dorsal in advance of the hind end of the base of the anal. Base of the anal one and one half times that of the second dorsal or five sixths of the distance from the subcaudal. Hind margins of ventrals very oblique.

Greyish; with broad dark-edged bands of brown across the back, and with less distinct intermediates of brown marblings or reticulations. Top of head reticulated; first band between the hinder parts of the eyes, convex on the backward edge; the second a pair of oval patches at the level of the gill openings, not quite meeting on the back; third at the hinder parts of the pectorals; fourth in front of the dorsal, broken into three sections; fifth and seventh crossing the bases of the dorsal fins; and several others appear on the tail toward the end. There is a large blotch of brown on each of the pectorals and the ventrals and on the upper portion of each dorsal.

Length of the type about thirteen inches (325 mm.).

Apparently a variety of *H. quagga* of Alcock.

Coast of Natal.

Halaelurus quagga.

Scyllium quagga Alcock, 1899, Cat. deep-sea fishes Indian mus., p. 17; 1900, Ill. zoöl. Investigator, pl. 27, f. 1.
Scyliorhinus quagga Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 461.

Head broad, depressed and bluntly acuminate at the end of the snout. Anterior nasal valves widely separated, with a very short and inconspicuous cirrus. Eyes large, length more than two thirds of that of the snout. Spiracles

small, close to the eye. Mouth large, with a short labial fold at the angles. Teeth tricuspid, median cusp longest. Dorsals subequal; origin of the first dorsal little in front of the hind ends of the bases of the ventrals; origin of the second dorsal little forward of the hinder end of the base of the anal. Hind margins of ventrals oblique. Base of the anal little longer than that of either of the dorsals, equal to half or more of its distance from the caudal.

Back with numerous, twenty or more, cross bands of dark brown separated by spaces of lighter, not passing to the lower surfaces; fins tipped with light color.

Type a male, apparently adult, eleven inches in length, taken off the coast of Malabar in 102 fathoms.

Halaelurus hispidus.

Scyllium hispidum Alcock, 1891, Ann. & mag. nat. hist., ser. 6, **8**, p. 21; 1894, Ill. zoöl. Investigator pl. 8, f. 3; 1899, Cat. deep-sea fishes Indian mus., p. 15.
Scyliorhinus hispidus Brauer, 1906, Valdivia Tiefsee fische, p. 7; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 460.

Head broad, depressed; snout broadly rounded, preoral portion in length less than half the width. Anterior nasal valves widely separated, with rudimentary cirri. Eyes large. Spiracles small, close to the eye. Labial folds at the angles of the mouth. Teeth three to five cusped, median cusp largest. Scales small, acutely tricuspid. Second dorsal the smaller. Origin of the first dorsal little in advance of the ends of the bases of the ventrals; origin of the second dorsal nearly above the middle of the anal base. Base of anal twice as long as that of the second dorsal the end of which is about opposite that of the anal, which latter is very near the origin of the subcaudal. Pectorals longer and broader than the ventrals. Ventrals oblique on the hind margins.

Dull grey.

Andaman Sea, at depths of 185 to 405 fathoms.

Halaelurus analis.

Scyllium anale Ogilby, 1885, Proc. Linn. soc. N. S. W., **10**, p. 445, 464.
Scyliorhinus analis Ogilby, 1889, Proc. Linn. soc. N. S. W., ser. 2, **4**, p. 180; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 460.
Catulus analis Waite, 1899, Mem. Austr. mus., **4**, p. 31, pl. 2, f. 1; 1905, Rec. Austr. mus., **6**, p. 228, pl. 40 (egg).

Body less than half of the total length. Head depressed; snout moderate, bluntly rounded, length equal the distance between the nostrils. Nostrils nearer to the mouth than to the tip of the snout; anterior valves short, not

reaching the mouth, not as wide as the space between them, slightly lobed at their outer angle; posterior valves short, broad, not confluent with the anterior at their inner edges. Mouth wide, somewhat angular in outline, arched around the symphysis, with a short labial fold around the angles on each jaw. Teeth small, striate based, smaller in three to five or more of the symphyseal rows, three to five cusped, median cusp largest. Eye medium, as long as the mouth. Spiracle small, near the corner of the eye. Gill openings moderate, hindmost two above the pectorals. Dorsals subequal, smaller than the anal; origin of the first dorsal above the hinder ends of the bases of the ventrals; origin of the second at the front end of the hindmost fifth of the anal base, base of the dorsal extending two thirds of its length behind that of the anal. Bases of the ventrals one and one half times that of the dorsal, hind margins of the fins oblique. Base of the anal nearly twice that of the dorsal, about two thirds of its distance from the caudal. Subcaudal narrow, width about one fourth of the length. Scales small, tricuspid, median cusp strong.

Olivaceous to greyish brown, with scattered small spots of darker, with eight or more blotches across the back; lower surfaces lighter, mottled. Here described from a female of 21 inches from Port Jackson.

New South Wales.

Halaelurus bivius.

Scyllium bivium A. Smith, 1837, Proc. Zool. soc. Lond., p. 85 (name only); Müller & Henle, 1841, Plagios, p. 8; Duméril, 1865, Elasm., p. 321; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 405.
Scyllium brevicolle Philippi, 1887, Ann. Univ. Chile, **71**, p. 561, pl. 7, f. 5.
Scyllium gayi Philippi, 1887, Zool. garten, p. 86.
Scyllium chilense, Vaillant, 1891, Cap Horn. Poissons, p. 10, pl. 1, f. 1.
Scylliorhinus chilensis Smitt, 1898, Bih. kon. Svenske vet.-akad. Handl., **24**, p. 72.
Scylliorhinus brevicollis Delfin, 1901, Cat. peces Chile, p. 15.
Scyliorhinus bivius Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 462.

Body shorter than the tail. Head short, broad, depressed. Snout short, narrowed forward, blunt. Nostrils with two valves; anterior valve not reaching the mouth, widely separated on the internarial space, without cirri; posterior valves short. Mouth large, with labial folds, around the angles, on each jaw about half its length. Eye moderate. Spiracles small, close to the angle of the eye. Gill openings moderate, hindmost two above the pectoral. First dorsal little smaller than the second, base two thirds to one half the length of that of the anal, about one third of the distance from the second dorsal, extending forward above the posterior third of the bases of the ventrals. Base of the second dorsal longer than that of the first, extending forward above the posterior third of the anal. Anal small, base little longer than that of the second dorsal,

little more than half the length of the distance from the caudal. Caudal short, not so deep as the other fins. Scales minute, tricuspid.

Greyish brown; back with indistinctly defined cross bands of darker, and with scattered spots of lighter and of darker on back and fins.

Off the coasts of Chile.

Halaelurus alcockii, sp. nov.

Scyllium canescens Alcock, 1896, Journ. Asiatic soc. Bengal, **65**, p. 310; 1899, Cat. deep-sea fishes Indian mus., p. 16.

Alcock's comparative description of this species proves satisfactorily that it is not *S. canescens* of Günther, 1878. The differences appear in a snout that is slightly longer relatively, an eye that is smaller, in larger labial folds, in the simple stiff prickles of the scales, in a larger second dorsal, and in a shorter anal for *H. alcockii*. The comparisons were made with *H. hispidus*, but it will be seen that they are even more decisive if that species is compared with *H. canescens*.

Greyish black, "almost black, blackish with a hoary gray surface."

Arabian Sea, 690–620 fathoms.

Halaelurus canescens.

Scyllium canescens Günther, 1878, Ann. mag. nat. hist., ser. 5, **2**, p. 18; 1887, Challenger rept. Zool., **22**, p. 1, pl. 1, f. A.
Scyliorhinus canescens Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 461.

Snout short, blunt, length of preoral portion less than its width. Anterior narial valves not reaching the mouth, widely separated from one another; the description says each valve is provided with a cirrus, but none is shown in the figure. The width of the mouth is greater than the length of the snout; there is a short labial fold on each jaw, around the angle. Teeth small, tricuspid on the lower jaw with subequal cusps. Eye large. Spiracles small, close to the angle of the eye. Dorsals, anal, and ventrals subequal. First dorsal slightly shorter than the second, origin above the middles of the bases of the ventrals. Hind margins of the ventrals oblique, bases ending below the middle of the dorsal. Second dorsal origin above the middle of the anal base. Anal fin not reaching as far back as the end of the base of the second dorsal. Subcaudal more than twice the length of the anal base. Shagreen rough. Type specimen an 11 inch female.

Uniform greyish; caudal tipped with darker; other fins tipped with white.

Southwestern coast of South America, in 400 fathoms.

Halaelurus labiosus.

Squalus maculatus Schneider, 1801, Bloch Ichth., p. 130 (not *Squalus maculatus* Bonn., 1788).
Scyllium maculatum Günth., 1870, Cat. fishes Brit. mus., **8**, p. 401.
Catulus labiosus Waite, 1905, Rec. Austr. mus., **6**, p. 57, f. 23.
Scyliorhinus maculatus Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 462.

Body shorter than the caudal region. Head short, depressed; snout short, broadly rounded across the end. Anterior nasal valves short, widely separated on the internarial space, with rounded outer angles, without cirri. Mouth wide, width nearly twice the length of the snout; labial folds long, around the angles of the mouth, reaching more than half the length of each jaw, the anterior extending nearly to the nostrils. Teeth tricuspid, median cusp largest, lower teeth larger. Gill openings narrow. First dorsal origin above the hind edge of the vent, that is, above the hinder portions of the bases of the ventrals. Ventrals obliquely truncated. Hind end of the base of the anal below the middle of the second dorsal. Base of anal little if any longer than that of the dorsal, shorter than the distance from the subcaudal.

Dark brown, with scattered spots of black, smaller than the eye, on the hinder part of the head and body, from the pectorals, and on the dorsals, the ventrals, the anal, and the caudal.

Reaches a length of more than two feet.

Australia.

Parmaturus.

Parmaturus Garman, 1906, Bull. M. C. Z., **46**, p. 203.

Body rounded, nearly as long as the tail. Snout short, thick, very vascular. Nostrils large, without a nasoral groove, with two valves; anterior valves short, widely separated across the internarial space, without a cirrus; posterior valves short. Dorsals small; first dorsal above the ventrals, second above the anal. Upper edge of caudal armed with modified scales somewhat as in species of the genus Pristiurus, but otherwise the general appearance approaches Catulus rather more.

Eastern Pacific to Japan.

Anal fin larger than the ventrals
inner angles of the dorsals blunt, rounded . . *pilosus* (page 89)
Anal fin smaller than the ventrals
inner angles of the dorsals sharp . . . . *xaniurus* (page 90)

Parmaturus pilosus.

Plate 8, fig. 1–5.

Parmaturus pilosus Garman, 1906, Bull. M. C. Z., 46, p. 204.

Body elongate, slender. Head broad, slightly arched above; snout broad, deep, blunt at the end as seen from the side, broadly rounded as seen from above. Tail long, compressed; caudal fin not deep, without a prominent subcaudal lobe, surmounted in three fifths of its length from its origin by a couple of series of enlarged scales separated by four series of small ones forming a comparatively broad armature immediately below each edge of which there is a narrow space free from scales that is probably sensory, or light producing. Nostrils large, equal in width to their distance apart, or to their distance from the end of the snout which latter is about three times their distance from the mouth. Anterior nasal valves short, without cirri, with a well developed rounded lobe crossing the middle of the nasal cavity, widely separated from one another; posterior valves short, not continuous with the anterior around the inner edge of the nostril. Mouth large, in width equal to two and one third times the length, or one and one half times the length of the snout; labial folds short, passing around the angles, of equal length on the jaws. Teeth compressed, asymmetrical; cusps sharp, varying in number from five to seven or nine, upper more often with six of which the fourth from the inner edge is largest, lower commonly with five, the third largest. Eye large, three fourths as long as the snout. Spiracle small, near the eye, in width equal to the distance from the orbit. Gill openings small, width of the foremost equal to half the length of the orbit, hindmost two above the pectoral, posterior one less than half the width of the foremost, much narrower than either of the first three.

Dorsal fins equal, middle of the base of the first dorsal in the middle of the total length, origin backward of that of the ventrals, base equal to two thirds of its distance from the second dorsal. Base of second dorsal equal the length of the snout from the eyes, origin above the middle of the base of the anal, end of base opposite that of the anal base. Pectorals short, width about three fourths of the length, which latter is equal to half the distance from the base to that of the ventral. Origin of ventrals little forward of that of the dorsal. Anal base about twice as long as that of a ventral. Scales minute, nearly erect, slightly bent backward, with a strong median cusp at each side of the base of which there is a much smaller one. The scales have a velvety appearance; they offer little more resistance when stroked toward the head.

Upper surfaces a warm brown, lower lighter, fins darker with blackish ends, inside of mouth and throat dark.

Description and figure from No. 1107 Mus. Comp. Zoöl., taken in Lat. 34° 59′ N., Long., 139° 31E, by Alan Owston.

Japan.

Parmaturus xaniurus.

Plate 9, fig. 1–5.

Catulus xaniurus Gilbert, 1891, Proc. U. S. nat. mus., **14**, p. 540; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 24.
Scyliorhinus xaniurus Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 453.

Body elongate, tail longer. Head broad, tapering forward; snout narrower, blunt. Nostrils large, width much greater than their distance apart, nearer to the mouth than to the end of the snout, bivalvular; anterior valves short, widely separated on the internarial space, outer angle produced in a narrow lobe, without cirri; posterior valves very short, separated from the anterior by some distance at the inner angle of the nostril. Mouth large, twice as wide as long, length equal to that of the snout; labial folds short, around the angles, lower longer. Teeth small, compressed, with three to seven cusps, median cusp less prominent toward the sides of the mouth. Eye large, nearly as long as the mouth. Spiracles small, a short distance behind the eye. Gill openings narrow, hindmost two above the pectoral.

First dorsal little the larger, origin behind that of the ventral, end opposite that of the latter. Space between the dorsals equal the length of the ventral bases. Base of the second dorsal about three fourths of the length of that of the anal, origin a little farther back and end of the base about opposite that of the latter. Bases of the pectorals thickly enveloped in muscles. Caudal moderately elongate, surmounted by a band of modified scales on the upper edge below which the skin is more naked. Subcaudal deeper forward, without a lobe. Anal smaller than the ventrals, much larger than the dorsals. Scales small, carinate or striate. Head, body cavity, color of mouth and other features differ considerably from what is seen on *P. pilosus;* but they approach no nearer to *Pristiurus.*

Upper surfaces brown, lower somewhat lighter, fins more or less blotched and bordered with white. Inside of mouth pale.

Description from a female of $21\frac{1}{2}$ inches, body $11\frac{1}{2}$ inches, taken off the Santa Barbara Islands, California.

Pristiurus.

Galeus Rafinesque, 1810, Caratteri, p. 13 (non Valmont, 1768).
Scyliorhinus Blainv., 1816, Bull. Soc. philom., p. 121 part.
Pristiurus Bonaparte, 1831, Saggio anim. vert., p. 121 (name only); 1841, Icon. Fauna Ital., Pesci.
Pristidurus Bonaparte, 1839, Mem. Soc. sci. Neuch., 2, p. 11 extr.

Body cavity less than half the total length. Snout elongate. Anterior nasal valves without cirri, widely separated from one another and from the mouth; posterior short, not extended backward. Eye large, lower lid with a fold. Spiracle small, near the eye. Mouth large, with labial folds on both jaws around the angles. Gill openings small, hindmost above the base of the pectoral. Teeth small, numerous, three to seven cusps, median cusp strongest. Anal and subcaudal rather large; dorsals small. Vertebral axis in the caudal not raised. Upper edge of caudal, in most species, with modified scales above a sensory area. Muscular portions of the pectoral bases closely enveloped by the muscles of the body. *P. hassei* Woodward is fossil from the Coral Limestones.

Mediterranean and Atlantic, Pacific to Japan and Formosa.

Colors on the body not uniform
- marked by longitudinal blotches and spots
  - base of the anal three times that of the first dorsal
    - base of second dorsal ending little in advance of that of the anal
      melastomus (page 92)
- marked by faint cross bands
  - base of the anal more than twice that of the first dorsal
    - base of second dorsal ending behind that of the anal
      eastmani (page 93)

Colors on the body uniform
- marked by black margins on anal and caudal
  - base of anal twice the length of that of second dorsal
    - base of second dorsal ending backward of that of the anal
      murinus (page 93)
- marked by black on upper portions of dorsals and caudal
  - base of second dorsal origin little behind mid base of anal
    - base of second dorsal ending behind end of anal base
      sauteri (page 94)
- markings none
  - base of anal two and one seventh times that of second dorsal
    - base of second dorsal ending little before that of anal
      spongiceps (page 94)

Pristiurus melastomus.

Haae gjale Ström, 1762, Söndm., **1**, 283.
Squalus catulus Gunner, 1766, Trondj. sels. selskr., **2**, p. 249.
Röd haae Ascanius, 1777, Icon., **4**, p. 5, pl. 38.
Galeus melastomus Rafinesque, 1810, Caratteri, p. 13.
Scyllium catulus ♀ Risso, 1810, Ichth. Nice, p. 30.
Scyllium artedi Risso, 1820, Journ. phys. chem. et hist. nat., **91**, p. 241; 1826, Hist. nat. **3**, Poissons, p. 117.
Squalus prionurus Otto, 1821, Conspectus, p. 5.
Scylliorhinus delarochianus Blainv., 1830, Poiss. Fr., p. 74.
Scylliorhinus melastomus Blainv., 1830, ibid., p. 75.
Squalus annulatus Nilsson, 1832, Prodromus, p. 114.
Scyllium melanostomum Jenyns, 1835, Man., p. 497; Bonaparte, 1841, Icon. Fauna Ital., Pesci; Kröyer, Danm. fiske, **3**, p. 832, fig.
Black-mouthed dog-fish Yarrell, 1836, Brit. fishes, p. 375, fig.; Couch, 1867, Brit. fishes, **1**, p. 18, pl. 3.
Pristidurus melanostomus Bonaparte, 1839, Mém. Soc. sci. Neuch., **2**, p. 11; Gray, 1851, Chondropterygii, p. 32.
Pristidurus melanostomus Müller & Henle, 1841, Plagios., p. 15, pl. 7; Lowe, 1860, Fishes Madeira, pl. 77, f. 22–23; Duméril, 1865, Elasm., p. 325; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 407; Gerv. & Boul., 1877, Poiss. Fr., **3**, pl. 77, f. 22–23; Malm, 1877, Göteb. och Bohus. fauna, p. 623; Gigl, 1880, Elenc., no. 525; Moreau, 1881, Poiss. France, **1**, p. 284, f. 34; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 28; Day, 1884, Brit. fishes, **2**, p. 314, pl. 160, f. 1; Jensen, 1907, Dan. fiske, p. 306, pl. 27, f. 2; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 463.
Scyllium annulatum Nilsson, 1855, Fisk. Skand., **4**, p. 713.
Pristiurus artedi Bocage & Capello, 1866, Plagios., p. 11.
Pristiurus atlanticus Vaillant, 1888, Travailleur et Talisman, Poissons, p. 59, pl. 1, f. 1.

Body shorter than the tail; head more than one sixth of the total length, broad, depressed; snout long, broad and broadly rounded across the end, with numerous pores. Nostrils large, without nasoral grooves, less than one third of the distance from the mouth to the tip of the snout; anterior valves very short, angled outward, widely separated across the internarial space, about equidistant from the mouth and from one another; posterior valves rudimentary. Mouth large, width nearly equal to the length of the snout, or equal to twice the oral length; labial folds short, less than one third of the length of the jaw, around the angle. Teeth small, in $\frac{34}{34}$ rows in the specimen in hand; symphyseal teeth very small, erect, with a lateral smaller cusp at each side; lateral teeth with two small cusps on the inner side of the larger median cusp and one or more on the outer side. Eye large, hardly half as long as the snout. Spiracle small, close behind the eye. Gill openings narrow, hindmost above the pectoral. Pectorals large, muscles of the bases closely bound with those of the body, fin long, broad, subtruncate on the hind margin, broadly rounded on the inner angle. Dorsals small, subequal; origin of the first dorsal above the hindmost fourth of the bases of the ventrals; origin of the second above the hinder half or two fifths of the base of the anal, and end of base opposite to that of the anal

or slightly farther forward. Base of the anal three times the length of that of the dorsal, acute end of the fin reaching beyond the origin of the caudal. Subcaudal one and one half times the length of the anal base, no produced lobe.

Brownish to grayish or yellowish brown, lighter below; commonly with two or more series of more or less elongate and ocellate spots of darker along the flanks surrounded and separated by other irregular spots or cloudings on the back and the sides; lower fins paler; inside of mouth and throat black.

Off the coasts of Europe, in the Atlantic and the Mediterranean.

Pristiurus eastmani.

Pristiurus eastmani Jord. & Snyder, 1904, Smith. misc. coll., **45**, p. 230, pl. 60; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 464.

Body slender, elongate; head small, narrow; snout rather acutely pointed, tail long, more than half of the total length, caudal fin nearly two sevenths of the total. Anterior nasal valves short, widely separated on the internarial space. Width of mouth equal the length of the snout; labial folds around the angles, short. Teeth with seven cusps, median cusp much the larger. Spiracle, half the width of the first gill opening, equal to the spiracular distance from the angle of the eye. Gill openings small, hindmost narrowest and above the pectoral. Scales minute, tricuspid, with a strong median keel. Dorsals small; origin of the first dorsal above the hind ends of the bases of the ventrals; origin of second dorsal in advance of the end of the anal base. Ventrals acute. Caudal with modified scales on its upper edge. Anal distant from the subcaudal.

Brownish, with eight or more transverse cloudings of a deeper shade. Free margins of dorsals, pectorals, and anal white. Lower surfaces lighter. Inside of mouth without the darker color.

Idzu Sea, Japan. Owston collection.

Pristiurus murinus.

Pristiurus murinus Collett, 1904, Forh. vid.-selsk. Chra., no. 9, p. 4; 1905, Suppl. Norges fiske, **3**, p. 32, pl. 1, f. 3; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 463.

Body shorter than the tail; head more than one fifth of the total length; snout elongate, more than twice the length of the mouth. Nostrils large; anterior valves short, widely separated on the internarial space. Mouth large, with labial folds, around the angles, on both jaws. Eye large, half or more of the length of the snout. Spiracle small, near the eye. Gill openings small, hindmost smallest and above the pectorals. Pectorals large, broad. Half or more

of the forward portion of the base of the first dorsal above the bases of the ventrals; end of the base behind the bases of the latter. Basal length of the second dorsal less than half of that of the anal and more than the forward half of it above the base of that fin. Caudal nearly one third of the total length.

Greyish brown, ends of dorsals, anal, and caudal darker.

Northwest of the Hebrides, in depths ranging from about 600–875 fathoms (1100–1300 m.).

Pristiurus sauteri.

Pristiurus sauteri Jordan & Richardson, 1910, Mem. Carnegie mus., **4**, p. 160, pl. 63, fig. 1.

More robust than *P. eastmani*. Head to first gill opening one fourth of the total length; snout four elevenths of the head. Internarial space equal width of nostril. Width of mouth little more than preoral length of snout. Teeth with a long median cusp, at each side of which is a lateral cusp half as long, which latter may or may not have one or two rudiments at its base. Spiracle small, one diameter behind the corner of the eye. Scales minute, with a median keel and cusp, larger in a couple of rows separated by four rows of smaller ones extending from the root of the caudal on a sort of keel along the upper edge of the fin. About half of the base of the first dorsal is above the hinder ends of the ventral bases. Second dorsal little smaller than the first, origin little behind the middle of the anal base. Interdorsal space more than twice the base of the first dorsal. Anal base more than twice that of the second dorsal; tip of fin not reaching a vertical from the end of that dorsal. Tip of caudal elongate, narrow; subcaudal lobe feeble, not produced.

Back brown; lighter below. Dorsals black anteriorly; white in hinder portions. Supracaudal blackish at the end; subcaudal lobe tipped with dark. Pectorals dark anteriorly, white backward and on margins.

Takao, Formosa.

Pristiurus spongiceps.

Catulus spongiceps Gilbert, 1905, Bull. U. S. fish. comm., **23**, p. 579.
Scyliorhinus spongiceps Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 459.

Body compressed, head depressed, snout soft, spongy, porous. Nasal valves widely separated, without cirri, terminating in thickened rounded lobes. Spiracles near the eye. Mouth wide, width greater than the length of the snout, with labial folds, lower fold extending half way to the symphysis, upper three fourths as long. Teeth five cusped (3–5), in 36 rows in the upper series. Dorsal fins equal, separated by one and one half times the length of the bases, that is,

by half the width of the mouth; first dorsal with not more than one fourth of its base behind the bases of the ventrals; second dorsal origin above the middle of the anal, base not reaching as far back as that of the latter. Base of the anal two and three tenths times that of the second dorsal. Pectoral base long, fin short. Scales minute, slender, simple, absent from the margins and behind the bases of the fins.

Uniform brown.

This species is placed in Pristiurus with some doubt. The proportions of the head are such as exist in that genus and in Apristurus. Preference is given the former because of smaller fins and because the modified scales are rather more likely to be lost than the unmodified.

Type an adult female of twenty inches, taken off Bird Island, Hawaii, in from 313 to 800 fathoms.

Pentanchus.

Pentanchus Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 490.

Form elongate, body cavity short; head long, depressed; snout pointed. Teeth, spiracles, gill openings, mouth, nostrils, fins, and scales in most respects similar to those of Pristiurus. Though it is in the great majority of its features closely allied to Pristiurus and Apristurus, Pentanchus differs from both, as from the other genera of the family, in the absence of the first dorsal fin. The genus is found at great depths and appears to be one of the most specialized of the Catulidae.

Philippine Islands.

Pentanchus profundicolus.

Pentanchus profundicolus Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 490, fig., pl. 42.

Head one fourth and body cavity about four ninths of the total length. Snout long, narrowing forward; pores large, many. Nostrils large, oblique, in the posterior half of the distance from mouth to end of snout. Eye in mid length of the head. Mouth wide, arched forward, with angles below the pupils, and with deep grooves around the angles, that on the upper jaw reaching more than half-way to the median line. Teeth small, numerous, alike in the two jaws, erect, with a larger median cusp and a smaller lateral at each side of the median. Scales small, leaf-shaped, with a median cusp and keel and a smaller lateral at each side of it. Gill openings small, hindmost above the bases of the pectorals. Spiracles small, near the orbits. A small dorsal, without a spine, above the hinder half of the anal, its origin nearly half way from the first gill opening to the end

of the tail. Pectorals large, broad, rounded at the angles, reaching the ventrals, which are much smaller. Claspers of the male round and thick. Vertebral axis of the tail nearly straight. Subcaudal long, a notch between it and the terminal. Anal long. Pectorals, ventrals, anal, and caudals have much the same appearance as those of *Apristurus indicus*, being rather close together.

The describers of this peculiar form have placed it in the Notidani between Hexanchus and Chlamydoselachus as an archaic type of a new family of Diplospondyli. This classification is undoubtedly due to misunderstanding, since the form is not archaic, but one of the most differentiated, and is not at all nearly allied to either Hexanchus or Chlamydoselachus as would be necessary to secure it a position in their group of the Antacea.

The type was about 20 inches in length, of a dark brown color, and was taken in the Sea of Mindanao at a depth of 585 fathoms.

Apristurus, gen. nov.

Body about half of the total length. Snout elongate. Anterior nasal valves separate from one another and from the mouth. Eye large. Spiracles small, near the eye. Mouth large, with labial folds on both jaws. Teeth small, three to five cusped. Gill openings small, hindmost above the pectoral. Dorsals small, inserted behind the body cavity. Pectorals moderate. Ventrals, anal, and subcaudal large, close together. Upper edge of the caudal not armed with enlarged scales. Vertebral axis of the caudal not raised. Distinguished from Pristiurus, the closest ally, by the larger and more closely placed lower fins and by lack of the caudal armature, and from Catulus and its closer allies by the elongate snout, the nasal valves, the lips, the labial folds, and the fins. Type species *Scylliorhinus indicus* Brauer.

Atlantic, Indian Ocean, Japan, and Eastern Pacific.

Pectorals, ventrals, anal, and subcaudal large
- ventrals, anal, and subcaudal narrowly separated
  - dorsal origin on a vertical from the vent
    - first dorsal the smaller . . . . *indicus* (page 97)
- ventrals and anal farther apart; anal and subcaudal close together
  - dorsal origin above the hind ends of the ventral bases
    - first dorsal about equal the second . *macrorhynchus* (page 97)
  - dorsal origin little in advance of the anal
    - first dorsal base longer than second . *platyrhynchus* (page 98)

Pectorals and ventrals moderate
ventrals and anal followed by a space
dorsal origin above ends of ventral bases
first dorsal about equal the second . *profundorum* (page 99)
dorsal origin little in advance of ends of ventral bases
first dorsal the smaller . . . . *brunneus* (page 99)

Apristurus indicus.

Scylliorhinus indicus Brauer, 1906, Valdivia Tiefsee fische, p. 8, pl. 14, f. 1; Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 459.

Head depressed; snout shovel-shaped, broadly rounded in front. "Die nasenlöcher sind nicht getrennt, an der vorderen und hinteren Klappe ein cirrus." The distance between the nostrils equals the width of the eye; the shortest distance between the nostril and the upper jaw is half as much. A labial fold from the angles of the mouth extends nearly half way to the symphysis. Teeth moderately large, five cusped. Spiracle at the hinder edge of the orbit. Hindmost gill opening above the pectoral. Pectorals broad, length equal that of head without the snout. Middle of ventrals in mid total length, smaller than the anal, base length equal the length of the snout. Dorsal fins small, second somewhat larger than the first. Origin of first dorsal on a vertical from the vent, a little behind the middle of the entire length of body and tail, base ending on a vertical from the origin of the anal. Second dorsal origin behind the middle of the anal, base ending on a vertical from the end of the anal base. Anal broad, origin close behind the ends of the bases of the ventrals, base about equal to length of the head from the snout to the hind border of the orbit. A notch separates the subcaudal from the terminal portion of the caudal; terminal elongate, rounded. Subcaudal deeper forward, without a produced lobe. Scales three cusped.

Brownish black.

Taken off the eastern coasts of Africa, Lat. 2° 58′ 8″ N., Long. 47° 6′ 1″ E., at a depth of 1289 m., and in the Gulf of Aden, Lat. 13° 1′ N., Long. 47° 10′ 9″ E., at a depth of 1840 m. Largest specimen nearly $13\frac{1}{4}$ inches in length.

Apristurus macrorhynchus.

Scyliorhinus macrorhynchus Tanaka, 1909, Journ. Coll. sci. Tokyo, **27**, p. 1.

Body rather slender, compressed. Head large, depressed. Snout long, pointed, rounded across the tip. Eye midway from the tip of the snout to the

middle of the pectoral bases; anterior edge of the orbit midway from the end of the snout to the third gill opening. Anterior nasal valves separated from one another and from the mouth. Spiracles very small, behind the eye. Mouth large, moderately arched; labial folds around the angles; lower fold two thirds as long as the upper, which latter nearly reaches the nostril; lower lip not overlapped by the upper. Gill openings narrow, hindmost above the pectoral. Pectorals moderate, not reaching the ventrals by a distance equal to that between the eye and the first gill opening. Dorsals subequal; interdorsal space less than the preocular length of the snout. Origin of the first dorsal above the hind ends of the bases of the ventrals. Hind end of the second dorsal base in advance of the hind end of the anal base by a space equal to two thirds of the diameter of the eye. Anal long, deep, narrowly separated from the subcaudal. Origins of the ventrals little nearer to the origin of the anal than to the hindmost gill opening. Caudal long, nearly one third of the total length. Scales small, three cusped, slightly enlarged on the caudal peduncle.

Total length of the type (♂) 47 cm.; snout to caudal 32.5, snout to second dorsal 29, snout to first dorsal 22, snout to pectorals 10.7, length of the dorsal bases 2.2, and length of the anal base 7.2 cm.

Dark grey, paler on the lower surfaces; fins with blackish anterior and whitish posterior margins; interior of mouth, gill chamber, and nostrils blackish.

Misaki, Sagami, Japan.

Apristurus platyrhynchus.

Scyliorhinus platyrhynchus Tanaka, 1909, Journ. Coll. sci. Tokyo, **27**, p. 4.

Body robust, moderately elongate, compressed and tapering backward; head large, depressed; snout pointed, broadly rounded across the end. Anterior narial valves separated from one another and from the mouth. Eye midway from the end of the snout to the fourth gill opening. Spiracle small, half the diameter of the pupil of the eye, near the orbit. Mouth moderate, angles farther from the end of the snout than from the first gill opening; lower lip not overlapped by the upper near the angles; labial folds on both jaws, lower fold extending about two fifths of the distance to the symphysis and upper nearly half way to the nostril. Teeth three cusped. Gill openings small, hindmost above the pectorals. Pectorals large, not reaching the ventrals. First dorsal small, origin little in advance of the origin of the anal. Base of the second dorsal two thirds as long as that of the first, origin above the end

of the anterior three fifths of the anal base. Anal long, not deep, deeper anteriorly, narrowly separated from the subcaudal. Vertebral axis of the caudal nearly horizontal, a slight notch between subcaudal and terminal. Scales very small.

Total length of the type (♂) 80 cm.: snout to caudal 56, snout to second dorsal 51, snout to first dorsal 40, snout to ventrals 28.5, snout to pectorals 16, snout to mouth 5.7, base of first dorsal 2.2, base of second dorsal 3.4, and base of anal 14.4 cm.

Blackish brown, paler below; hind edges of the fins, edges of gill openings and inside of mouth black.

Japan.

Apristurus profundorum.

Scylliorhinus profundorum Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 17, pl. 5, f. 16; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 225; 1900, ibid., Atlas, pl. 3, f. 11; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 460.

Length of snout about equal to the width of the mouth, or twice the distance from the first gill opening to the last one. Anterior nasal valves short, widely separated on the internarial space. Mouth wide; labial folds extending around the angle on both jaws, lower reaching half way to the symphysis. Teeth five cusped, median cusp largest. Half or more of the base of the first dorsal behind the bases of the ventrals. Origin of the second dorsal above the middle of the base of the anal, the end being opposed to that of the latter. Basal length of the anal about twice that of the dorsal. Caudal nearly one third of the total length.

Uniform greyish brown.

Taken in Lat. 39° 09′ N., Long. 72° 03′ W., at a depth of 816 fathoms.

Apristurus brunneus.

Catulus brunneus Gilbert, 1891, Proc. U. S. nat. mus., **14**, p. 542; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 24.
Scyliorhinus brunneus Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 549.

Body slightly compressed, shorter than the tail; head somewhat narrowed; snout elongate, rather pointed, its length from the mouth nearly equal to the width of the latter. Nostrils large, nearer to the mouth than to the end of the snout. Mouth with labial folds, the lower of which is shorter than the upper and extends half way to the symphysis. Teeth with three to five cusps; median cusp long, sharp, strongly curved back and outward. Orbit one third of the

length of the snout. Spiracle separated from the orbit by nearly one third of the orbital length. Gill openings moderate, hindmost two above the base of the pectoral. Fleshy portions of the pectorals closely bound up with the muscles of the body, angles of fins rounded, hind margins nearly straight. Base of first dorsal extending little backward of the bases of the ventrals. Second dorsal the longer, base reaching little behind the base of the anal. Anal base very long, two and one half times the length of the base of the first dorsal. Caudal three elevenths of the total length. Scales minute, three cusped. Caudal without modified scales on its upper edge.

Uniform warm brown; snout and margins of fins blackish.

Original description from a twenty inch female containing two eggs, the cases of which were peculiarly constricted toward each end.

Off the western coasts of North America.

Atelomycterus, gen. nov.

Form somewhat like that of Chiloscyllium, elongate, slender, body cavity short, tail longer. Eye large, orbit long; lower lid well differentiated, upper edge closing inside of the upper lid, with a fold and apparently translucent or semitransparent. Spiracle small, close to the eye. Nostrils nearly midway from the mouth to the end of the snout, with a rudimentary nasoral groove, without cirri, without posterior nasal valves; anterior valves reaching the mouth in rounded lobes, separated by a median attachment in front of the symphysis of the jaws. Mouth with long labial folds and strong jaws. Teeth small, three cusped, median cusp longest. Gill openings moderate, hindmost above the pectorals. Pectorals small, rounded. Dorsals larger than the anal, origin of first dorsal above the ventrals; hind angles of dorsals and anal produced. Subcaudal narrow, without a prominent lobe.

India to the Archipelago.

Atelomycterus marmoratus.

Scyllium marmoratum Bennett, 1830, Mem. Raffles, p. 693.

Scyllium maculatum Gray & Hardwicke, 1832, Ill. Ind. zool., **1**, pl. 98, f. 1; Müller & Henle, 1841, Plagios., p. 5, pl. 7; Richardson, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 193; T. Cantor, 1849, Malay, fishes. p. 1373; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 16; Duméril, 1865, Elasm., p. 319; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 400.

Scyliorhinus marmoratus Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 462.

Body slender forward, resembling that of Chiloscyllium rather than that of Scyliorhinus, less than half of the total length. Head nearly one sixth of the

total, narrow, depressed forward. Snout blunt, short, as long as the orbit or the distance between the nostrils, rounded at the end. Nostrils small, half as far from the mouth as from the end of the snout, without posterior valves, without cirri; anterior valves reaching the mouth, in rounded lobes, separated by a considerable median attachment in front of the symphysis. Mouth large, with long labial folds around the angles. Eyes large, with a decided fold in the lower lid, which is more or less transparent; orbit long. Spiracles small, close to the eye. Gill openings wide, two thirds of the orbit, hindmost much narrower, above the pectoral. Fins all small; angles of dorsals and anal produced; pectorals rounded. Origin of the first dorsal above the middle of the ventral, of the second above the forward half of the anal, interdorsal space twice the length of the base of the first dorsal. Anal smaller than the second dorsal. Subcaudal short, not deep. Claspers of the male long, slender, styliform. Scales small, sharp, with a strong median cusp, and with rudimentary lateral cusps.

Light brownish; young with about twelve transverse bands of brown on the back, separated by pairs of white spots or light blotches, fins with dark brown blotches and white ends; lower surfaces whitish. Adults are darker, more irregularly spotted and blotched with brown, less banded, and retain spots of the white as brown-edged ocelli. Fully adult males, from Penang and Singapore, measure eighteen and three fourths inches, females an inch more.

India; Malay Archipelago.

Haploblepharus, gen. nov.

Shape resembling that of Halaelurus or Cephaloscyllium, body short, caudal section longer. Head broad, flattened. Snout short, rather pointed. Eye medium; orbit elongate; lower lid not attached within the upper lid, but closing against it, without a fold. Spiracle small, close to the eye. Nostrils nearer to the mouth than to the end of the snout, with a nasoral groove, without cirri, without posterior valves; anterior valves reaching the mouth in a wide angular flap, forming a broad lip narrowly attached in the middle. Mouth medium, with strong labial folds around the angle. Teeth minute, numerous, each tooth with a strong median and weaker lateral cusps. Gill openings medium, hindmost narrow, above the pectoral. Subcaudal small, without a prominent lobe. Hind angles of dorsals and anal not produced.

Off southern Africa.

Haploblepharus edwardsii.

Squalus catulus Edwards, 1764, Gleanings, **3**, tab. 289.
Scyllium d'edwards Cuv., 1817, Reg. anim., **2**, p. 124.
Scyllium edwardsii Voigt, 1832, Thierreich, **2**, p. 504; Müller & Henle, 1841, Plagios., p. 4, pl. 1; Duméril, 1865, Elasm., p. 319; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 401.
Scyllium pictum Müller & Henle, 1841, Plagios., p. 4, 189.
Scyliorhinus edwardsii Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 463.

Head short, about two elevenths of the total length, rather broad and depressed; snout short, twice as long as the mouth. Nostrils small, nearer to the teeth than to the end of the snout, with a deep groove to the mouth; anterior valves without cirri, reaching the mouth, forming a broad angular lip with a narrow median, presymphyseal, attachment; no posterior nasal valves. Mouth wide, length one third of the width, with moderate labial valves around the angles. Eye small; orbit elongate, narrow; lower lid without a fold, opaque, closing against the edge of the upper lid. Spiracle small, close behind the eye. Gill openings moderate, equal the width of a narial valve, hindmost smallest and above the pectoral. Outer angles of fins rounded. Pectorals large, broad, hardly reaching halfway to the ventrals. Dorsals small, equal, separated by more than twice the length of the dorsal base; anterior dorsal origin behind the ends of the ventral bases; second dorsal origin at the end of the base of the anal; inner angles not produced. Anal one third larger than the dorsals, narrow, elongate. Subcaudal short, narrow, tapering forward and backward. Scales small, with a strong carinate median cusp and with shorter lateral cusps.

Light yellowish brown, with broad irregular, dark-edged, transverse bands of darker on the back, and with small reticulations of brown or small spots of yellowish on back and fins. One band crosses the hind part of the orbit, another the hindmost gill aperture, another is at the ends of the pectorals, and one each passes through the dorsals and the caudal pedicel. Lower surfaces lighter, unspotted. Description from a specimen of 19 inches, of which the length from the snout to the abdominal pores was eight inches.

Off the coasts of South Africa.

Proscyllium.

Proscyllium Hilgendorf, 1904, Sitzb. Ges. nat. freunde Berlin, p. 39.

Head and snout elongate. Anterior nasal valves separate from one another and from the mouth. Mouth large. Pectorals small. Dorsals small, inner angle produced; first dorsal in part forward of the ventrals. Anal long, distant from the subcaudal.

Lack of details concerning dentition, squamation, labial folds, etc., in the description of the single known species prevents determination of its affinities with any degree of certainty. Apparently it is nearer to Pristiurus than to Catulus.

Formosa.

Proscyllium habereri.

Scyllium (Proscyllium) habereri Hilgendorf, 1904, Sitzb. Ges. nat. freunde Berlin, p. 39.

Head depressed, length twice the width, or less than one fifth of the total length; snout elongate, more than half as long as the head. Nostrils slightly oblique; anterior valves not joined, and not reaching to the mouth. Mouth large, width little more than its distance from the end of the snout, outline on the lower jaws forming a triangle from which the apex is rounded off about one fourth of the altitude, *i. e.*, one fourth of the length of the mouth. Pectorals small, base about two thirds of that of the first dorsal. Dorsal origin one fourth of the length of its base forward of the origins of the ventrals. Hinder angle of the dorsals slightly produced. Base of anal extending nearly one seventh of its length forward of the base of the second dorsal and about two and one half times as much backward of it; its length is less than half its distance from the subcaudal and is about twice the length of the base of the second dorsal. Length of the subcaudal greater than its distance from the base of the anal. A notch between subcaudal and terminal.

Scattered small spots of black on the back, more elongate on the head, and smaller spots of white in a row on the side.

Total length 510, snout to vent 210, snout to pectorals about 90, and length of snout 26 mm.

Southwest coast of Formosa, near Takao.

Pseudotriakidae.

The large sharks placed in this family are closely allied to the Catulidae. They differ in the length of the body as compared with that of the tail and in the position of the first dorsal fin above the body cavity, in advance of the ventral fins. The nostrils are separate from one another and from the mouth, the spiracles are of moderate size, the mouth is very large, the eyes are lateral and are without nictitating folds, the dorsals are not preceded by spines, an anal fin is present, the caudal is of moderate length, is without a pit at its root and, in the subcaudal portion, is without a prominent lobe.

Pseudotriakis.

Pseudotriakis Capello, 1867, Jor. sci. math. phys. nat. Lisboa, **1**, p. 315, 321.

Snout short, depressed, tapering, blunted at the end. Nostrils near the mouth. Mouth very large, with short labial folds around the angles on both jaws. Teeth numerous, small, with a strong median cusp, and with small lateral cusps. First dorsal the longer, in advance of the ventrals; second dorsal larger than the anal. Pectorals short, broad. Anal below the second dorsal and smaller. Subcaudal not produced in a lobe. One species is described from the North Atlantic and another from the Northern Pacific; they are not to be distinguished by means of the present material.

Pseudotriakis microdon.

Pseudotriakis microdon Capello, 1867, Jor. sci. math. phys. nat. Lisboa, **1**, p. 315, 321, pl. 5, f. 1; 1869, Jor. Acad. sci. Lisbon, **7**, p. 139; Bean, 1883, Proc. U. S. nat. mus., **6**, p. 147; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 18, pl. 5, f. 17; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 27; 1900, ibid., Atlas, pl. 4, f. 14.

Pseudotriacis microdon Günth., 1870, Cat. fishes Brit. mus., **8**, p. 395; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 464.

Body moderately stout, caudal region shorter. Head one fifth of the total length, depressed; snout short, tapering, blunt. Mouth large, reaching forward to nearly half way from eye to end of snout, in width equal to nearly three times the preoral length. Spiracle moderate, length equal half the width of the fourth gill opening. Hindmost gill opening above the pectoral. First dorsal long and low, origin backward from the ends of the pectorals, distant from the snout little more than twice the length of the pectorals. Second dorsal higher and shorter than the first, base longer than the interdorsal space, hind angle slightly produced. Anal entirely below the second dorsal, base about two thirds of the length of that of the latter. Subcaudal without a produced lobe, separated from the terminal by a notch, origin below the end of the anal fin. Origins of the ventrals little in advance of the hind end of the first dorsal base.

Brown, hind margins of ventrals, second dorsal, anal, and caudal darker.

Atlantic; off the coasts of Portugal; off the east coasts of the United States. Capello's type was captured off Setubal.

Pseudotriakis acrages.

Pseudotriakis acrales Jordan & Snyder, 1904, Smith. misc. coll., **45**, p. 232, pl. 62.
Pseudotriacis acrales Regan, 1908, Ann. & mag. nat. hist., ser. 8, **1**, p. 464.

Body much longer than the tail. Head about one fifth of the total length, depressed, little convex across the crown, tapering from the angles of the mouth forward. Snout short, narrowed, blunt. Nostrils much nearer to the mouth than to the end of the snout; free edges of both anterior and posterior valves short, equal, on the inner halves of the nostrils, without cirri. Mouth very large, outline subtriangular and narrowly rounded at the symphysis of the jaws, with a short labial fold around the angles, lower fold twice as long as the upper. Teeth small, in 208 rows on the upper jaws, three cusped near the middle of the mouth, with strong median cusps and striate bases, with three to five cusps toward the angles, where they are asymmetrical and the cusps are more equal. Eye small, orbit half as long as the snout, above the mid length of the mouth; lids without a fold, meeting against one another if closed. Spiracle small, half as long as the eye, little less than the distance behind the orbit. Width of gill openings little more than the orbital length, hindmost one above the pectoral. Pectorals short, length equal that of the head from snout to spiracle, width equal three fourths of the length. First dorsal as long as the head to the last gill opening, upper margin in a low curve from end to end, origin about midway from the hindmost gill opening to the ventrals, end of base nearly opposite the ventral origins, hind angle slightly produced. Second dorsal more than twice as long as high, origin about opposite the ends of the ventrals, hind angle slightly produced, end of base little behind the base of the anal, tip reaching the origin of the caudal. Anal much smaller than the second dorsal, origin behind the anterior fourth of the same fin, hind angle hardly produced. Bases of the ventrals shorter than the second dorsal base, longer than the base of the anal, outer angles broadly rounded. Vertebral axis of the caudal rising little. Subcaudal little shorter than the head, not deep, lobe not produced, separated from the terminal by a notch. Scales minute, resembling those of *Parmaturus pilosus* (Plate 8, fig. 4, 5), without the lateral notches on the crown, with a sharp median keel.

Total length 85 inches, snout to abdominal pores 51, snout to second dorsal 54, snout to first dorsal 32, snout to pectorals 16, snout to mouth 4, width of mouth $8\frac{1}{2}$, length of pectorals $8\frac{1}{2}$, width of pectorals 6, and length of caudal fins 18, base of first dorsal 13, base of second dorsal 10, and base of anal 7 inches.

Uniform brown.

Hardly distinct from *P. microdon*.

The specific name originally given was acrales, said to mean dumb or speechless, from the Greek. The Greek word for voiceless, not yelling, is Ἀκρᾰ́γής, Acrages.

Pacific; near Japan.

Carcharinidae.

Body elongate; head and snout depressed; tail compressed; eyes lateral, provided with a more or less perfectly developed nictitating membrane; nostrils below the snout; mouth crescent-shaped, inferior; two dorsals, not preceded by a spine, the first dorsal forward of the ventrals; an anal fin.

In this family the teeth have been the principal aid in classification, both among the living and among the fossil forms that have been discovered at numerous levels since the early Tertiary.

Teeth compressed, one cusped; one series in function; a nictitating membrane; caudal pits

spiracle minute

teeth not serrated, subequal in both jaws, oblique, notched *Loxodon* (page 107)

spiracle absent

teeth not serrated, bases swollen, points slender, oblique *Physodon* (page 108)

teeth not serrated, bases not swollen, cusps oblique in both jaws *Scoliodon* (page 109)

teeth not serrated, cusps rather slender, upper nearly erect, lower erect *Aprionodon* (page 117)

teeth with serrations on the base in the upper series only *Hypoprion* (page 120)

teeth serrated, some or all, on bases and cusps

first dorsal near the pectorals . . *Carcharinus* (page 123)

teeth serrated, slightly swollen, cusps oblique

first dorsal near the ventrals . . . *Galeus* (page 145)

spiracles minute

teeth serrated on both jaws, upper teeth oblique *Thalassorhinus* (page 146)

teeth large, subequal on both jaws, oblique

labial fold along upper jaw; subcaudal long *Galeocerdo* (page 148)

teeth on the upper jaw only denticulated

labial folds on both jaws, subcaudal long *Hemigaleus* (page 149)

spiracles small; caudal pits rudimentary; subcaudal short

teeth serrated, notched, oblique; labial folds *Eugaleus* (page 152)

Loxodon.

Loxodon Müller & Henle, 1838, Charlesworth's mag., **2**, p. 36; 1841, Plagios., p. 61.

Head depressed. Body elongate, cavity less than half the total length. Mouth greatly arched. Teeth oblique, subequal, with smooth edges the outer of which is deeply notched near the base. A short labial fold. Eye moderate, pupil rounded, orbit elongate; nictitating membrane well developed, below the eye. Spiracle pore-like, behind the orbit. Dorsal above the space between the pectorals and the ventrals; second dorsal small, near the caudal. Caudal long, pointed, subcaudal lobe large. A pit in front of the caudal above and another below. A notch behind the subcaudal.

Indian Ocean.

Loxodon macrorhinus.

Loxodon macrorhinus Müller & Henle, 1841, Plagios., p. 61, pl. 25; Duméril, 1865, Elasm., 395; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 376.

Form slender; head moderately broad; snout long, length from the mouth equal to the distance from the angles of the latter to the hindmost gill opening, blunted at the end. Nostrils midway from the mouth to the end of the snout; nasal valve with a sharp lobe. Length of mouth about half the width; labial folds short, around the angle. Teeth in $\frac{25}{28}$ rows, oblique, cusp inclined outward over a deep notch on the outer edge, not denticulated, median or symphyseal more erect and smaller, others subequal. Orbit longer than wide, nearly as long as the mouth, longer than the space between eye and nostril. Pectorals medium, width less than two thirds of the length, reaching slightly beyond the origin of the dorsal, angles rounded, hind margin a shallow concave. Dorsal smaller than the pectorals, above the space between pectorals and ventrals, origin more than a length of the base farther back than the end of the base of the pectoral, reaching a vertical from the ventrals, upper angle produced, rounded, hinder angle acute, rather short. Ventrals small, nearer to the first dorsal than to the anal. Anal small, larger than the second dorsal, nearer to the caudal than to the ventrals, lower angle rounded, hinder produced, hind margins with a shallow indentation. Second dorsal much smaller than the anal, origin above the end of the anal base. Caudal long, slender, acuminate, fins narrow, subcaudal lobe prominent.

Total length of specimen described 17, snout to abdominal pores $7\frac{1}{2}$, head, to hindmost gill opening, $3\frac{3}{8}$, caudal fins $5\frac{1}{4}$ inches.

Greyish brown, edges of fins lighter; whitish below.

Mauritius; Indian Ocean.

Physodon.

Physodon Müller & Henle, 1841, Plagios., p. 30.

Body slender, compressed; head long, depressed, snout long. Teeth not serrated, anterior raptorial, with long crooked cusps bent toward the angles of the mouth; bases broad, somewhat swollen. A small median tooth on the upper jaws and two small symphyseal teeth on the lower. Mouth with a short labial fold. Pectorals short, subtruncate. First dorsal nearer to ventrals than to pectorals. Anal much longer than second dorsal.

India; China.

Physodon mülleri.

Carcharias (*Physodon*) *mülleri* Müller & Henle, 1841, Plagios., p. 30, pl. 19, f. 1 (teeth); Duméril, 1865, Elasm., p. 347; Günth., 1870, Cat. fishes Brit. mus., 8, p. 360.

Elongate, slender, body cavity nearly half the total length. Head broader than deep, snout long, broad, pointed, about one third of the length to the fifth gill cleft. Nostrils at about one fifth of the length from the mouth forward, far apart. Mouth greatly arched, little wider than long, with a short labial fold in the angle and on the lower jaw. Teeth smooth on the edges, in $\frac{27}{28}$ rows; one median tooth on the upper jaws, two symphyseal teeth on the lower; cusps of forward teeth long, sharp, resembling those of Isurus in outline, but more compressed, with base wide and swollen and with a deep notch behind the cusp. Eyes small, lateral, above the middle of the mouth, nictitating membrane anterior. Gill clefts wider than the eye, equal, hindmost one above the edge of the pectoral. Fins small. Pectorals subtruncate, inner angle about 90°. Origin of first dorsal about midway between the bases of pectorals and ventrals, base not reaching to a vertical from the origins of the ventrals, hind angle acute, above the middle of the ventral. Second dorsal very small; base less than one third of either first dorsal or anal, extending little farther back than that of the anal; hind angle acuminate. Base of anal distant its length from that of the caudal or from the bases of the ventrals. Tail with a distinct pit in front of the supracaudal. Caudals moderate, subcaudal lobe medium. Scales very small, with three strong keels each of which is produced in a sharp point. Distal end of clasper of male with four blades the third of which is smaller, short, rounded, and toothed on the edge.

Back brownish; below whitish; fins darker, except on the edges.

Specimen described an adult male from China. Total length $17\frac{1}{2}$, snout to pores $8\frac{1}{2}$, snout to fifth gill opening $3\frac{3}{4}$, snout to mouth $1\frac{3}{8}$ inches.

Scoliodon.

Scoliodon Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 114; Wiegm. arch., p. 397.
Scoliodon and *Aprionodon* Gill, 1861, Proc. Acad. nat. sci. Phil., p. 59 extra.

Body compressed; head depressed, snout elongate, blunt. Mouth inferior, greatly arched, with short labial folds at the angles. Teeth alike in the two jaws, sectorial, more or less smooth on the edges, broad based, with a triangular cusp that is inclined outward over a notch above the base on the outer edge; a median upper tooth, and two symphyseal teeth in the lower series, smaller in some species. Nictitating membrane well developed. Caudal pits distinct; subcaudal lobe prominent. Scales minute, with three to five keels.

Of general distribution and fossil in Lower Eocene and later.

Base of the anal more than twice the length of that of the second dorsal
  labial folds short, on the lower jaws, not on the upper
    sorrakowah (page 110)
Base of anal not more than twice that of second dorsal
  labial folds short, on the lower jaws, not on the upper *palasorrah* (page 111)
  labial folds in the angles
    length of snout nearly equal the distance from eye to pectoral
      dumérilii (page 111)
  labial folds in the angles and slightly on the lower jaws
    distance between outer angles of nostrils and between them and end of snout about equal
      anal and second dorsal unequal, latter posterior
        walbeehmi (page 112)
      anal and second dorsal subequal opposed *porosus* (page 112)
  labial folds on both jaws, hardly $\frac{1}{3}$ the length of the jaws
    snout pointed, length from nostrils nearly equal the distance between their outer angles . . . . . *lalandii* (page 113)
  labial folds on both jaws, about $\frac{1}{3}$ length of jaws
    snout rather pointed, length from nostrils about equal distance between their outer angles . . . . . *longurio* (page 114)
  labial folds on both jaws short, less than $\frac{1}{3}$ length of jaws
    snout broadly rounded
      length from the nostrils much less than distance between their outer angles . . . . . *terrae novae* (page 115)

snout rounded
length from the nostrils little less than the distance between their outer angles . . . . . *intermedius* (page 115)
labial folds subequal, elongate
snout broad, blunt
teeth with fine serrations . . . . *vagatus* (page 116)

Scoliodon sorrakowah.

Sorra kowah Russell, 1803, Coromandel fishes, **1**, p. 9, pl. 15.
Carcharias sorrakowah Cuv., 1829, Reg. anim., **2**, p. 388; Bleeker, 1853; Verh. Bat. gen., **25**, p. 80.
Scoliodon laticaudus Müller & Henle, 1841, Plagios., p. 27.
Carcharias (Scoliodon) laticaudus Müller & Henle, 1841, Plagios., p. 28, pl. 8; Duméril, 1865, Elasm., p. 343; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 358; Day, 1878, Ind. fishes, p. 712, pl. 188, f. 1.
Carcharias (Scoliodon) macrorhynchos Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 31, pl. 1, f. 1; Duméril, 1865, Elasm., p. 343.

Head long, depressed; snout longer than the distance from the eye to the first gill opening, blunted at the end. Nostrils nearer to the mouth than to the end of the snout. Mouth little wider than long, outline subangular in front; labial folds short, on the lower jaws, not on the upper. Teeth in $\frac{23}{22}$ to $\frac{27}{28}$ rows; bases broad; cusps inclined obliquely out toward the angle of the mouth, sectorial, not serrated, the forward or cutting edge slightly concave to straight. A small erect median tooth in the upper series, two small symphyseal teeth on the lower. Fins rather small. Pectorals little longer than wide, not reaching a vertical from the origin of the dorsal, hind margin concave. Base of first dorsal nearly equal to the distance between the bases of the ventrals and the anal, little more than that between anal and caudal, ending slightly forward of the ventral. Ventrals small, origin below the produced extremity of the dorsal. Base of anal elongate, equal to its distance from the caudal, fin acute. Base of second dorsal less than half that of the anal, mid length above the end of base of the anal, fin acuminate, not reaching the caudal pit. Tail moderate, subcaudal lobe prominent. Scales small, with three (3–5) strong keels which are produced as spines.

Light rusty brownish on the back; light to white below; fins darker, darkening with age; caudal dark-edged above, white below; white of lower surfaces extending to sides of head and snout.

Total length $13\frac{1}{2}$, snout to abdominal pores $6\frac{3}{4}$, snout to hindmost gill cleft $3\frac{1}{8}$, and snout to mouth $1\frac{1}{8}$ inches.

Specimen described from Singapore, collected by Capt. W. H. Putnam.

Scoliodon palasorrah.

Pala sorra Russell, 1803, Coromandel fishes, **1**, p. 9, pl. 14.
Carcharias palasorrah Cuv., 1829, Reg. anim., **2**, p. 388; Bleeker, 1853, Verh. Bat. gen., **25**, p. 80.
Carcharias acutus Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 65, pl. 18, f. 4.
Carcharias (*Scoliodon*) *acutus* Müller & Henle, 1841, Plagios., p. 29; Richardson, 1846, Rept. Brit. Assoc. adv. sci. for 1845, p. 194; T. Cantor, 1849, Malay. fishes, p. 1381; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 30; Duméril, 1865, Elasm., p. 345; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 358; Day, 1878, Ind. fishes, p. 712, pl. 188, f. 2.
Carcharias (*Scoliodon*) *crenidens* Klunzinger, 1879, Sitzb. Akad. wiss. Wien, **80**, p. 102.

Head depressed; snout long, narrowed forward, rounded at the end. Length of snout from the mouth nearly equal to the distance from the eye to the first gill opening. Nostrils nearer to the end of the snout than to the corners of the mouth. Mouth arched, wider than long; labial folds short, on the lower jaws, not on the upper. Teeth in $\frac{25}{26}$ rows; median tooth of upper jaws erect, not small; the two symphyseal teeth of the lower jaws hardly smaller than the others. Pectorals longer than broad, rather sharp angled, reaching the dorsal. Base of the first dorsal nearer to the ventrals than to the bases of the pectorals. Origin of the second dorsal above the end of the anal base, length of the dorsal base about one third of its distance from the caudal; base of anal about twice as long, equal half of its distance from the subcaudal or hardly half of its distance from the bases of the ventrals. Ventrals smaller than the anal. Posterior margins of pectorals, first dorsal and anal concave.

Back brownish; lower surfaces and margins of pectorals whitish.

India and East Indies.

Scoliodon dumérilii.

Carcharias (*Scoliodon*) *dumérilii* Bleeker, 1856, Act. Soc. sci. Ind. Neerl., I, Amboina, p. 70; Duméril, 1865, Elasm., p. 344; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 359.

Body elongate, compressed. Head much broader than deep, length of snout twice that of the mouth, three times the diameter of the eye. Nostrils midway from the angles of the mouth to the end of the snout. Labial folds short, in the angles. Teeth not serrated; median upper tooth small, erect. Pectorals much longer than wide, reaching the dorsal, concave on the hind border, distant from the eye about the length of the snout from the mouth. First dorsal little closer to ventrals than to pectorals. Length of anal base about one third of its distance from the ventrals. Caudal pointed.

Distinguished from *S. walbeehmi* by length of snout, position of nostrils, shortness of labial folds, position of the first dorsal, length of pectorals, and colors.

Back brown; pectorals black narrowly bordered with white.

Amboina.

Scoliodon walbeehmi.

Carcharias (*Scoliodon*) *walbeehmi* Bleeker, 1856, Nat. tijds. Ned. Ind., **10**, p. 353; Duméril, 1865, Elasm., p. 344; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 359.

Head elongate, pointed; snout one and one half times the length of the mouth, rounded at the end. Mouth narrowing forward, rounded in front; labial folds short, extended more on the lower jaws than on the upper. Nostrils about twice as far from the end of the snout as from the mouth, distance apart less than the length of the mouth. Eye small, orbit about half the length of the mouth, less than the distance from the nostril, equal the width of a gill opening. Hindmost two of the gill openings above the pectoral. Teeth in $\frac{23}{22}$ rows, bases broad, cusps obliquely inclined toward the angles of the mouth above a decided notch in the hinder edge; median tooth in the upper series and the two symphyseal teeth in the lower smaller, nearly erect; inner or cutting edge concave near the apex of the cusp. Scales minute, 5-carinate. Ventrals, second dorsal, and anal small. Pectorals more pointed on the outer angle, more indented on the hind margin, and sharper on the inner angle than on *S. laticaudus*. Origin of first dorsal opposite the end of the inner angle of the pectoral, produced hinder angle reaching a vertical from the origins of the ventrals. Length of anal base less than half the distance from the bases of the ventrals, two thirds of its distance from the caudal. Base of second dorsal half as long as that of the anal, end of fin not reaching the caudal pit. Caudal moderate, deep across the subcaudal lobe, slender backward.

Back brown; lower surface white; fins dark with light margins, excepting the upper edge of the caudal and the lower edge of the hinder portion of the subcaudal which are dark.

Total length 18, snout to pores $8\frac{3}{4}$, snout to fifth gill opening $3\frac{3}{4}$, and snout to mouth $1\frac{1}{4}$ inches.

Specimens described from Singapore and Columbo; Penang.

Scoliodon porosus.

Squalus porosus Poey, 1860, Memorias Cuba, **2**, p. 339, tab. 19, f. 11, 12.
Scoliodon porosus Poey, 1868, Repertorio, **2**, p. 452; 1876, An. Soc. Esp. hist. nat., **5**, p. 200.

This species somewhat resembles *S. terrae novae* in shapes and proportions and in positions of the fins. In comparing a Cuban specimen of *S. porosus*, from Professor Poey, of about fifteen inches with one of *S. terrae novae* of equal size, from South Carolina, the following divergences are patent: — *S. porosus* is the

less depressed in forehead and snout, is narrower in the snout and deeper in the head and more pointed anteriorly, has a smaller mouth, has much shorter labial folds around the buccal angles, where the folds extend but little on the lower jaws and not much more on the upper, has the cutting edges of the teeth weakly serrated and somewhat curved, has wider gill openings, has longer more falciform and acute pectoral fins, has a taller first dorsal that is more pointed on the upper angle, has a much deeper and sharper subcaudal lobe, has much deeper excavations behind anal and subcaudal, has larger flatter scales commonly quinque-carinate with extremities of the median keels less produced than those of *S. terrae novae*, and it has the bases of the second dorsal and the anal almost directly opposed, though the end of the latter extends slightly farther back.

Cuba. No. 1380 M. C. Z.

Scoliodon lalandii.

Carcharias (*Scoliodon*) *lalandii* Müller & Henle, 1841, Plagios., p. 30; Duméril, 1865, Elasm., p. 346.
Scoliodon terrae novae Ribeiro, 1907, Arch. Mus. nac., **14**, p. 138.

Head long; snout elongate, pointed, sharper and longer than that of *S. terrae novae*, nostrils at about two sevenths of the distance from the mouth to the end. Mouth large, width greater than the length; labial fold on upper jaw nearly one third of the length, lower little shorter. Teeth in $\frac{25}{24}$ rows, broad based, with slender cusps turned toward the angle of the mouth and slightly curved toward the opposite teeth, and with a notch above the base on the outer edge. Eye large, midway from first gill cleft to end of snout. Gill openings as wide as the orbit. Nictitating membrane below and somewhat in front of the eye. Pectorals medium, reaching the dorsal; angles rounded. Origin of first dorsal above the inner angle of the pectoral, produced extremity not quite reaching a vertical from the origin of the ventrals. Base of second dorsal half as long as that of the anal, or one fourth of that of the first dorsal, one third above the end of the anal base. Second dorsal fin ending one length of the base forward of the caudal, and two and one half lengths behind the base of the first dorsal. Tail one fourth of the total length. Caudal large, end pointed, angles rounded, lower lobe deep and rather wide, blunt.

Slaty brown to olivaceous on back and fins, shading to white below, from the middle of the flank; hind borders of fins light.

Scoliodon terrae novae has the snout broader, the nostrils farther forward, the hind margin of the first dorsal more excavated, more nearly vertical, and the fin smaller. *Scoliodon longurio* also has the nostrils farther forward, the

dorsal smaller and the hind border more nearly vertical. The cusps of the teeth appear to be longer and more slender in *S. lalandii* than in either of the others mentioned.

Total length of an adult male from Rio Janeiro 23, snout to abdominal pores 11, snout to fifth gill opening $5\frac{1}{4}$, and snout to mouth $1\frac{7}{8}$ inches.

Off the eastern coasts of South America. Hassler Expedition.

Scoliodon longurio.

Carcharias (Scoliodon) longurio Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 106.
Scoliodon longurio Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 42.

Head long; snout more pointed than that of *S. lalandii*, the nearest ally; nostrils at nearly one third of the distance from the mouth to the end; distance between nostrils equal their distance from the end of the snout, which equals the length of the mouth. Mouth large, broad, broadly arched in front, length equal two thirds of the width; labial folds extending about one third of the length on each jaw. Teeth in $\frac{27}{26}$ rows; bases broad; cusps turned toward the angles of the mouth above a notch on the outer border. Median tooth, and the two symphyseal teeth of the lower series smaller, more erect. The teeth cusps in this species appear to be more erect and broader than in either *S. lalandii* or *S. terrae novae*. Eye large, pupil vertical. Hind margin of the pectoral slightly indented, inner angle bluntly rounded, outer angle more pointed and slender than in *S. lalandii*. First dorsal origin little behind the inner angle of the pectoral, fin smaller and more deeply excavated behind than in *S. lalandii*; end of fin not reaching above origins of ventrals by about one length of the orbit. Second dorsal very small, base one fourth of that of the first, two thirds of that of the anal, distant three times its length from the caudal pit. Lobe of subcaudal deep, rather narrow, blunt.

Total length 31, snout to pores $15\frac{1}{2}$, snout to fifth gill opening 7, and snout to mouth $2\frac{1}{2}$ inches.

Back slaty brown shading to white on the flanks and below; hind margins of pectorals and anal, and front of subcaudal lighter, other margins of caudal darker, all darker on adults.

Mexico to Panama, in the Eastern Pacific.

Scoliodon terrae novae.

Plate 2, fig. 1–4.

Squalus punctatus Mitch., 1815, N. Y. lit. & philos. trans., 1, p. 483 (non *punctatus* Schn. & Bloch).
Squalus (Carcharias) terrae novae Richardson, 1836, Fauna Bor. Amer., 3, p. 289.
Aprionodon punctatus Gill, 1861, Proc. Acad. nat. sci. Phil., p. 59 extra.
Scoliodon terrae novae Gill, 1861, ibid.; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 24; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 13.
Carcharias (Scoliodon) terrae novae Duméril, 1865, Elasm., p. 346; Günth., 1870, Cat. fishes Brit. mus., 8, p. 358 (part).

Head broader than deep, snout elongate, less than twice as long as the mouth, broad and broadly rounded from the eyes to the end. Nostrils little nearer to the mouth than to the end of the snout. Mouth greatly arched, length two thirds of the width; a short labial fold on each jaw, upper little longer. Teeth in $\frac{25}{24}$ rows, median upper erect and hardly smaller, lateral teeth with cusps inclined toward the angles of the mouth over a notch on the outer edge. Eye large, pupil vertical, hind border of orbit equidistant from first gill cleft and end of snout. Inner angle of pectoral slightly produced, rounded, reaching a vertical from the origin of the first dorsal. Hinder angles of dorsals and anal produced, acuminate. First dorsal about as large as the pectorals, origin above their inner angles, end hardly reaching above origins of ventrals. Second dorsal smaller and farther back than the anal, middle of its base above end of anal base. Tail about two sevenths of the total length; lower lobe of caudal well developed.

Back brown, olivaceous to greyish, hind margins of pectorals white. Lower surface white. On smaller individuals a dark edging to caudal and dorsals. Description from a female of thirty-two and one half inches secured in the Bahamas by Dr. Thomas Barbour. Total length of a specimen from Mobile 23, snout to abdominal pores 11, snout to fifth gill aperture 5, and snout to mouth $1\frac{5}{8}$ inches.

Labrador to Brazil.

Scoliodon intermedius, sp. nov.

Body compressed; head elongate, depressed; snout moderately broad, longer, narrower and less broadly rounded than that of *S. terrae novae*, less pointed than that of *S. lalandii*, twice as long as the mouth. Outer angles of nostrils nearer to end of snout than to angles of mouth. Eye medium, diameter greater than width of gill openings, twice in the length of the mouth. Mouth

in a somewhat pointed arch; labial fold on upper jaw about two sevenths of its length, that on lower jaw little shorter, partly hidden at the angle. Teeth in $\frac{25}{26}$ rows, deeply notched on the hind margin, broad based, cusps inclined outward, concave on the inner margin. Median tooth of the upper series and the two symphyseal teeth of the lower smaller and more erect than the others. Gill openings rather narrow, hindmost two above the pectoral. Outer angle of the pectoral reaching below the middle of the base of the dorsal, hind margin concave, inner angle extending little behind a vertical from the dorsal origin. Hind angle of first dorsal about reaching a vertical from the origin of the ventrals; base two and one half times its length in advance of the second dorsal. Second dorsal very small, its acuminate end extended little more than half way from its base to the caudal pit. Base of anal nearly twice the length of that of the second dorsal, ending below the middle of the latter, hind margin deeply excavated. Ventrals about equal the anal, inner angles much less produced. Length of caudal less than one third of the total, subcaudal lobe prominent, caudal pits distinct. Scales minute, the five keels produced as short spines.

Total length $20\frac{1}{4}$, snout to pores $9\frac{3}{4}$, snout to fifth gill opening $4\frac{1}{4}$, snout to mouth $1\frac{5}{8}$, and length of caudal $5\frac{3}{8}$ inches.

Back brown, shading to white below from the flanks and the sides of the head; hind margins of pectorals white.

Philippines; East Indies.

Scoliodon vagatus, sp. nov.

Head long; crown straight longitudinally, convex transversely; snout long, broad, convex on the sides, blunt pointed at the end. Distance between the outer angles of the nostrils greater than their distance from the end of the snout. Eye large, distance from end of snout equal that from the first gill opening, length of orbit little more than one fourth of the length of the snout. Mouth large, length less than two thirds of the width; labial folds on both jaws, upper reaching half way to below the middle of the eye, equal the width of the orbit, lower little shorter. Teeth in $\frac{12+1+13}{13+13}$ rows; bases very broad; cusps rather narrow and short; inner or cutting edge much inclined toward the angles of the mouth and concave; apex more erect; outer edge deeply notched; both edges with fine serrations near the base. On the upper teeth the cusps are little broader and the inner edges are less concave. Greatest width of the pectorals about two thirds of the length, outer angle sharp, extending behind the middle of the base of the dorsal, hind margin concave. Origin of the first dorsal

above the inner extremity of the pectoral, length equal height or two fifths of the distance between the dorsal bases, hind margin deeply concave, hinder angle acuminate, not quite reaching a vertical from the origin of the ventrals. Ventrals small, outer angles rounded, hinder blunted. Second dorsal small, hinder angle much produced; base equal half its distance from the caudal, middle above the end of the anal base. Anal twice as large as second dorsal, length of base nearly half the distance between it and the bases of the ventrals. Caudal more than one fourth of the total length, sharp at the end; subcaudal lobe rather acute.

Light ashy or yellowish brown, whitish on the hinder edges of pectorals and subcaudal; lower surfaces whitish.

Total length $32\frac{1}{2}$, snout to abdominal pores $16\frac{1}{4}$, snout to fifth gill opening $7\frac{1}{2}$, snout to mouth $2\frac{5}{8}$, and length of caudal $8\frac{1}{2}$ inches.

Specimen described from Zanzibar, collected by the late Caleb Cooke.

Aprionodon.

Aprion Müller & Henle, 1841, Plagios., p. 31 (preoccupied).
Aprionodon Gill, 1861, Proc. Acad. nat. sci., Phil., p. 59 extra (name only); 1861, Ann. N. Y. lyc., 7, 411.

General features of form, shapes and positions of fins, etc., like those of species of Carcharinus, but differing somewhat in dentition. The teeth are compressed; they are unserrated on the edges of the rather narrow nearly erect cusps; the bases are broad. Fossil species occur in the Lower Tertiary.

Red Sea, Indian Ocean and Archipelago; Western Atlantic.

Snout elongate, tapering
second dorsal smaller than anal, origin farther back
origin of first dorsal above inner angle of pectoral
brevipinna (page 117)

Snout short, broad
second dorsal larger than anal, origin little farther forward
origin of first dorsal little back of inner angle of pectoral
acutidens (page 118)
second dorsal nearly equal anal, origin at end of anal base
origin of first dorsal nearly above inner angle of pectoral
isodon (page 119)

Aprionodon brevipinna.

Carcharias (*Aprion*) *brevipinna* Müller & Henle, 1841, Plagios., p. 31, pl. 9; Bleeker, 1852, Plagios., p. 25.
Carcharias (*Prionodon*) *brevipinna* Bleeker, 1853, Nat. tijds. Ned. Ind., 4, p. 509.

Carcharias (*Aprionodon*) *brevipinna* Gill, 1861, Ann. N. Y. lyc., **7**, p. 411 (name only); Duméril, 1865, Elasm., p. 348; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 361.

Body moderate, fins rather small. Head depressed, nearly one fourth of the total length, tapering to the bluntly rounded end of the snout. Snout produced, narrowed forward, preoral length equal distance from eye to gill opening. Length of orbit little greater than width of nostril, nearly equal width of gill opening; nasal valve without a pointed lobe. Mouth large, broadly arched, labial folds in the angles only. Teeth small, in $\frac{36}{33}$ rows, not serrated; bases broad, without denticulation; cusps narrow, upper erect or nearly so, median small, median lower small with a row of small teeth at each side of it. Pectorals subfalciform, hind margin somewhat indented, angles blunted, outer angle reaching the end of the base of the dorsal. Origin of dorsal above the inner angle of the pectoral; base about one length forward of the bases of the ventrals, length less than half its distance from the second dorsal. Anal little smaller than the ventrals, larger than the second dorsal and origin farther forward, hind margin much indented, hind angle produced and reaching half way from the base to the caudal. Second dorsal small, above the anal but origin a trifle farther back, base distant twice its length from the caudal pit. Caudal about one fourth of the total length, pointed, subcaudal lobe produced, sharp.

Java.

Aprionodon acutidens.

Carcharias acutidens Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 65, pl. 18, f. 3; Klunzinger, 1871, Syn. fische, **2**, p. 217; Day, 1878, Ind. fishes, p. 713; Günth., 1910, Südsee fische, **3**, p. 478.
Carcharias (*Aprionodon*) *acutidens* Duméril, 1865, Elasm., p. 349; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 361.

Head less than one fourth of the total length, broad, depressed, with sides curving from behind the eyes to the end of the snout. Snout short, length little more than that of the mouth, much less than the width of the latter. Nostrils about opposite the middle of the preoral space, nearer to the eye than to the end of the snout, with prominent inner valves. Eye small, much nearer to the end of the snout than to the first gill opening. Width of mouth equal twice its length. Labial folds short, upper directed outward and a little forward, lower hidden in the angle. Teeth in 27–29, $\frac{30}{29}$, rows, not serrated, with broad bases and lanceolate, narrow, erect cusps, upper with a shallow notch at side on the base. Gill openings wide, width more than twice the length of orbit. Pectorals large, width about four fifths of the greatest length, outer angle sharp, hind margin concave, fin very little falciform. Origin of first dorsal little behind the inner

angle of the pectoral, acuminate hinder extremity reaching slightly backward of the origins of the ventrals, end of base about twice the length of the orbit farther forward, hind margin concave. Second dorsal smaller than the first, larger than the anal, less than twice the base farther back than that of the first dorsal, hind margin deeply indented. Anal smaller than second dorsal, little more excavated on the hind margin; base opposite the middle of that of the second dorsal and about three fourths of the length, distance from the caudal about equal. Caudal medium, less than one fourth of the total, lower lobe not much produced.

Ashy or greyish brown, edges of hindmost fins blackish; lower surfaces lighter.

Total length 34, snout to abdominal pores 18, snout to fifth gill opening $7\frac{1}{2}$, snout to mouth 2, and caudal $8\frac{1}{4}$ inches.

Approaches toward the genus Triaenodon appear in the positions and relative proportions of the fins, and in a notch at each side of the cusp on the bases of the upper teeth.

Indian Ocean and Archipelago; Red Sea. Specimen described from Apiang, taken by Andrew Garrett.

Aprionodon isodon.

Carcharias (*Aprion*) *isodon* Müller & Henle, 1841, Plagios., p. 32.
Aprionodon punctatus Gill, 1861, Ann. N. Y. lyc., **7**, p. 401; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 24.
Carcharias (*Aprionodon*) *isodon* Duméril, 1865, Elasm., p. 349.
Carcharias (*Aprionodon*) *punctatus* Günth., 1870, Cat. fishes Brit. mus., **8**, p. 361.
Aprionodon isodon Poey, 1876, An. Soc. Esp. hist. nat., **5**, p. 200; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 42.

Snout much shorter than that of *A. brevipinna*, blunt, distance from the angle of the mouth to the nostril twice that from the nostril to the end of the snout, preoral length equal the distance between the nostrils. Width of nostrils hardly less than length of orbits. Teeth erect, without serrations, in $\frac{31}{31}$ rows; upper small with broad bases; lower similar but smaller; median teeth small. Pectorals subfalciform, reaching the hind end of the base of the first dorsal. Second dorsal much smaller than the first, above the anal. The pectorals in this species are larger comparatively than those of *A. brevipinna;* in positions and forms of the other fins the two are alike. Originally described from a specimen, about two feet in length, said to have been collected at New York.

Western Atlantic.

Hypoprion.

Hypoprion Müller & Henle, 1841, Plagios., p. 34.
Hypoprionodon Gill, 1861, Ann. N. Y. lyc., **7**, p. 399.

Hardly distinct from species of Carcharinus in which the lower teeth are erect and smooth on the edges, and the bases only of the upper teeth are serrated.

Indian Ocean and Archipelago; West Indies. Fossil in the Miocene.

Second dorsal larger than anal, and origin little farther back
snout short, broad
origin of first dorsal about midway from snout to caudal pit
brevirostris (page 120)

Second dorsal smaller than anal and origin above hinder third of its base
snout elongate, pointed
origin of first dorsal above inner angle of pectoral *macloti* (page 121)

Second dorsal smaller than anal, origin little behind that of anal
snout moderate, shorter than that of *H. macloti*
origin of first dorsal close behind the pectoral *hemiodon* (page 122)

Second dorsal and anal equal and opposed
snout broad and broadly rounded
first dorsal nearer to bases of pectorals than to ventrals
playfairii (page 122)

snout elongate, sharp
first dorsal $\frac{1}{4}$ length of base farther back than pectorals
signatus (page 122)

Hypoprion brevirostris.

Hypoprion brevirostris Poey, 1868, Repertorio, **2**, p. 451, pl. 4, f. 5, 6, 20; 1876, An. Soc. Esp. hist. nat., **5**, p. 198; Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 581; 1883, Bull. 16, U. S. nat. mus., p. 61; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 41.
Carcharias (*Hypoprion*) *brevirostris* Günth., 1870, Cat. fishes Brit. mus., **8**, p. 362.
Carcharias brevirostris Jordan, 1884, Proc. U. S. nat. mus., **7**, p. 104.

Body rather stout, compressed; head large, depressed; snout short, broad, blunt; nostrils behind the middle of the preoral length, valves with a sharp lobe. Mouth with a short fold at the angle. Teeth broad-based, two-rooted, narrow-cusped, in $\frac{31-33-35}{31-33}$ rows; upper with triangular, unserrated cusps rising from serrated shoulders on the base; lower with somewhat narrower cusps on bases without serrations. The only serrations on the teeth of this species are those on the basal processes of the upper series. In three rows at the symphysis the teeth are smaller, those in the median rows are very small. Gill clefts wide. Eye

small, pupil vertical. Pectorals broad, rather sharp, reaching behind the origin of the dorsal, hind margin concave.

Origin of first dorsal nearly midway from snout to caudal pit, end above origins of ventrals, base above the middle of the space between pectorals and ventrals, upper angle sharp, hinder produced. Second dorsal nearly as large as the first, above the anal, acuminate extremity not reaching the caudal pit. The dorsals are large and nearly equal in size. Ventrals and anal smaller than the second dorsal; anal below the second dorsal with origin a little in front. Caudal medium with a strong lower lobe.

Uniform greyish olive or olivaceous grey, tips of fins slightly darkened.

A specimen taken by Prof. Geo. B. Shattuck at the Bahamas contained nineteen young each about eighteen inches in length. In a specimen secured by Mrs. Celeste N. Willard at Pensacola, Florida, the rows of teeth are $\frac{35}{33}$. Poey's types were from Cuba.

Hypoprion macloti.

Carcharias (*Hypoprion*) *macloti* Müller & Henle, 1841, Plagios., p. 34, pl. 10; Duméril, 1865, Elasm., p. 350; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 362.

Body moderately stout; head long, one fourth of the total, tapering. Snout elongate, pointed. Nostrils much nearer to the mouth than to the end of the snout; valve with a small pointed lobe. Eye moderate, length of orbit nearly equal distance from nostril. Mouth large, greatly arched, its width equal two thirds of the snout, or one and one third times the length; labial folds at the angles, not extended on the jaws. Teeth in 27 rows, slightly oblique; upper denticulated on the base at each side of a rather narrow cusp, symphyseal rows of smaller teeth; lower cusps narrower, bases smooth, median tooth small. Pectoral moderate, falciform, two thirds as wide as long, angles slightly blunted. Dorsal origin above the inner end of the pectoral, hinder angle acuminate, nearly reaching a vertical from the ventrals. Anal small, origin forward of that of the second dorsal, hinder margin concave, hind angle produced. Second dorsal smaller than the anal, origin above the hinder third of the base of the latter, base distant from that of the first dorsal about one fourth of the total length, or about the length of the caudal, acuminate extremity not quite reaching the caudal pit. Caudal equal length of head to the fifth gill opening; subcaudal lobe prominent, sharp. Scales minute, three to five keels.

Brownish gray; lighter below.

New Guinea; Indian Ocean.

Hypoprion hemiodon.

Carcharias (*Hypoprion*) *hemiodon* Müller & Henle, 1841, Plagios., p. 35, pl. 19, f. 2 (teeth); Duméril, 1865, Elasm., p. 351; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 362; Day, 1878, Ind. Fishes, p. 714.
Hypoprionodon hemiodon Gill, 1861, Ann. N. Y. lyc., **7**, p. 409 (name only).

Snout moderate, blunt, much shorter than that of *P. macloti*. Nostrils little smaller than the eyes, midway in the preoral length. Teeth in $\frac{29-32}{29-27}$ rows; upper subtriangular, slightly oblique, smooth on the inner edge, notched on the outer and bearing several blunt denticles on the basal portion; lower not serrated, cusps narrower, on broad bases, nearly erect. A row of smaller median teeth above and below. Distance between the outer angles of the nostrils equal that between end of snout and mouth. Outer and inner angles of pectorals rounded, hind margins concave. First dorsal close behind the pectoral, upper angle rounded, hinder acuminate, hind margin indented. Second dorsal above the anal, origin little behind that of the latter, base two thirds the length of the anal base, upper angle blunt, hinder acuminate. Hind angle of anal acute, hinder margin deeply notched. In teeth at hand the serrations on the outer part of the base of the lower teeth are nearly as distinct as those on the bases of the upper teeth.

Blackish gray; lighter below.

Pondicherry; India; Calcutta.

Hypoprion playfairii.

Carcharias (*Hypoprion*) *playfairii* Günther, 1870, Cat. fishes Brit. mus., **8**, p. 362.

Snout short, broadly rounded, preoral length two thirds of the width and rather more than the length of the mouth; nostrils midway to the end. Teeth erect, with narrowed cusps on broad two-rooted bases, in $\frac{29}{28}$ rows; upper rather wider than the lower, with obtuse denticulations on the bases. Orbits much narrower than the gill openings. Pectorals moderate in length and width, not reaching the end of the dorsal. Dorsal nearer to the bases of the pectorals than to the ventrals. Second dorsal one third as large as the first, equal and exactly opposite to the anal. Caudal one fourth of the total length.

A black spot on the end of each of the fins.

Zanzibar.

Hypoprion signatus.

Hypoprion signatus Poey, 1868, Repertorio, **2**, p. 452, pl. 4, f. 7, 8; 1876, An. Soc. Esp. hist. nat., **5**, p. 199; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 41.
Hypoprion longirostris Poey, 1876, An. Soc. Esp. hist. nat., **5**, p. 198, pl. 9, f. 8, 9.

Snout elongate, sharp, preoral length equal to six sevenths of the width of the mouth; nostrils at two fifths of the distance from the mouth to the end, nasal valve with a sharp lobe near the inner angle of the nostril. Diameter of eyes greater than width of nostril. Teeth in 31 rows, cusps narrower, bases broad, two rooted; upper little broader in the cusp, with denticulations at each side on the basal process; lower more erect, smaller, without denticulations. Length of pectoral equal the distance from the nostril, width equal five sevenths of the length, fin pointed, subfalciform. First dorsal moderately pointed, origin one fourth the length of the base farther back than the pectoral. Second dorsal opposite the anal, hind border nearly straight, base not half the length of that of the first dorsal; hind margin of anal indented, base like that of second dorsal. Caudal about one fourth of the total length, more than twice the length of the subcaudal lobe.

The differences between the types of *H. signatus* and *H. longirostris* apparently are no greater than those obtaining in individuals of the same species; at the inner side of the bases of the teeth on the type of *H. longirostris* the denticles are more distinct.

Cuba.

Carcharinus.

Carcharinus Blainv., 1816, Bull. Soc. philom., p. 121 (part); 1830, Poiss. Fr., p. 88.
Carcharias Cuv., 1817, Reg. anim., **2**, p. 125 (part; non *Carcharias* Raf., 1810).
Prionodon Müller & Henle, 1841, Plagios., p. 35 (part).
Eulamia Gill, 1861, Ann. N. Y. lyc., **7**, p. 401.
Platypodon, Isogomphodon, Lamiopsis, Isoplagiodon Gill, 1861, ibid.

Snout produced in front. Nostrils inferior, separated from the mouth and from one another. Mouth inferior, curved forward, labial folds rudimentary or short. Teeth compressed, subtriangular, with a single large sharp cusp. Eyes with a well-developed nictitating membrane. No spiracles. First dorsal generally the larger, opposite the space between the pectorals and the ventrals. Tail with pits at the root of the caudal; vertebral axis of the caudal moderately raised; subcaudal lobe produced.

Numerous species have been found fossil in the Eocene and later formations.

Second dorsal smaller than the anal, origin farther forward
snout short, broadly rounded, nostrils about mid length
teeth serrated, upper broad, triangular, lower narrower
pectorals $\frac{2}{3}$ as broad as long, reaching little beyond dorsal origin
platyodon (page 126)

Second dorsal smaller than anal, origins opposed
snout elongate
teeth nearly erect, cusps narrow, serrated in upper, less in lower
pectorals subfalciform, reaching below mid dorsal
limbatus (page 127)
snout moderate, rather pointed
teeth serrated, upper broader, oblique . . *brachyurus* (page 128)
snout pointed before the eyes, length less than width of mouth
teeth serrated, upper triangular, slightly oblique
amblyrhynchus (page 128)
snout blunt
teeth serrated in upper jaw, nearly smooth in lower
pectorals falciform . . . . *falciformis* (page 129)
Second dorsal smaller than the anal, origin farther backward
snout elongate, pointed, rather narrow
teeth serrated, upper deeply notched, lower cusps narrow
pectorals subfalciform . . . . . *velox* (page 130)
snout broad, broadly rounded
teeth serrated, upper cusps broad, lower lanceolate
pectorals nearly twice as long as wide . *obscurus* (page 130)
teeth serrated, upper cusps broader, lower narrowly triangular
pectorals broad, reaching below greater part of dorsal base
porosus (page 131)
snout moderate blunt, nostrils about mid length
teeth broad, with stronger denticles below the notch at the base
pectorals falciform, more than half as broad as long
sorrah (page 132)
Second dorsal about equal the anal, origin farther forward
snout broad, short, blunt
teeth serrated, upper broad, oblique, lower narrower
pectorals subfalciform, longer than broad *milberti* (page 133)
teeth serrated, subequal in form and size
pectorals longer than in *C. milberti*, hind margin deeply concave
amboinensis (page 134)
snout short, broadly rounded
teeth serrated, broad-based, upper cusps wider, lower nearly smooth
pectorals falciform, outer angle sharp . *melanopterus* (page 134)

Second dorsal about equal the anal, origins opposed
snout obtusely pointed
teeth serrated more coarsely toward the base, upper broader
pectorals $\frac{2}{3}$ as wide as long . . . *menisorrah* (page 135)
snout elongate, moderately pointed
teeth serrated, upper subtriangular, lower like those of Scoliodon
pectorals broad . . . . . *acronotus* (page 136)
snout somewhat produced
teeth serrated, upper oblique, notched, lower narrow more erect
pectorals twice as long as wide . . *spallanzanii* (page 136)
snout moderate, bluntly rounded
teeth serrated, upper oblique, notched, lower smaller, more erect
pectorals less than twice as long as broad *dussumieri* (page 137)
snout rather produced and pointed
teeth broad-based, upper serrated, lower narrower smooth
pleurotaenia (page 137)
Second dorsal origin backward of that of the anal
snout narrowly rounded in front
teeth oblique, upper with 2–3 denticles on outward end of base; lower smooth . . . . . *borneensis* (page 138)
snout rather abruptly narrowed in front of eyes
teeth serrated, broad-based, nearly erect, lower cusps narrower
remotus (page 138)
Second dorsal larger than the anal, origin farther forward
snout very short, nostrils near the end
upper teeth broad, serrated
pectoral long, shorter than in *C. commersonii*
gangeticus (page 139)
snout moderate
upper teeth broad, triangular, serrated
pectorals long, moderately broad . *commersonii* (page 140)
pectorals long, narrow . . . *albimarginatus* (page 141)
snout short, blunt; teeth serrated
upper teeth broad, triangular, lower narrow, chisel-shaped
pectorals large, more than half as wide as long
glyphis (page 141)

upper teeth narrow, lower narrower, lanceolate
pectorals broad . . . . . *ellioti* (page 142)
upper teeth broad, triangular, lower narrow
pectorals little longer than wide . . *temminckii* (page 142)
snout long, pointed; origin of second dorsal forward of anal
upper teeth like the lower, narrow, erect
pectorals large, two thirds as broad as long *oxyrhynchus* (page 143)
snout moderate, blunt; second dorsal origin opposite the anal origin
upper teeth broad, triangular, lower narrower
pectorals longer than broad . . . *munsing* (page 144)
snout very short, blunt; second dorsal origin behind anal base
upper and lower teeth triangular, smooth
pectorals elongate . . . . . *maou* (page 144)

Carcharinus platyodon.

Plate **3**, fig. 4–6.

Squalus platyodon Poey, 1861, Memorias Cuba, **2**, p. 336, pl. 19, f. 5, 6.
Squalus obtusus Poey, 1861, ibid., p. 337, pl. 19, f. 7, 8.
Eulamia obtusa Poey, 1868, Repertorio, **2**, p. 447, pl. 4, f. 1, 2; 1876, An. Soc. Esp. hist. nat., **5**, p. 189.
Carcharias platyodon Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 243; 1883, Bull. 16, U. S. nat. mus., p. 872, 967.
Carcharinus platyodon Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 39.

Head broad, convex. Snout depressed short, broadly rounded in front, in length equal to width of mouth. Nostrils about midway from mouth to end of snout; width of internarial space less than length of snout and greater than length of mouth. Mouth wide, greatly arched forward, with a very short labial fold visible on the upper jaw at the angle of the mouth. Teeth serrated, compressed, nearly erect, in $\frac{28}{28}$ rows; one to three very small hooked teeth at the symphyseal between the larger ones; upper teeth broad triangular, with a shallow concavity on the inner margin and a trifle more pronounced one on the more acuminate cusps; lower more erect, with narrower outer edge near the base. Eye moderate, nictitating membrane well developed. Gill openings narrow, as wide as the eye, hindmost two above the pectoral. Outer angles of all the fins rounded. Pectoral larger than the first dorsal, inner angle reaching beyond a vertical from the origin of the first dorsal. First dorsal large, nearer to bases of pectorals than to ventrals, origin little in front of inner angle of pectoral. Interdorsal space less than length of head. Hinder angles of dorsals and anal acute. Second dorsal very small, origin behind extreme ends of ventrals, in front of

origin of anal. Anal little larger than the second dorsal, originating below the middle of its base, and extending farther back in both base and tip. Caudal long, more than one fourth of the total; subcaudal lobe deep, rounded; terminal small. Scales small, with three to five keels. Description from a seventeen inch specimen taken at Guadaloupe, W. I.

Back slaty or ashy gray to olivaceous; whitish below; outer angles of dorsals and caudal with a small spot of black on the tip (young), pectorals, ventrals, and anal each with a larger spot.

Reaches a length of ten feet or more.

Common in the Gulf of Mexico and, about the West Indies, in the Caribbean.

Carcharinus limbatus.

Carcharias (*Prionodon*) *limbatus* Müller & Henle, 1841, Plagios., p. 49, pl. 19, f. 9; Duméril, 1865, Elasm., p. 375; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 373; Day, 1878, Ind. fishes, p. 716 (non fig.); Steindachner, 1906, Sitzb. Akad. wiss. Wien, **115**, p. 1425.
Carcharias microps Lowe, 1840, Proc. Zool. soc. Lond., p. 38; 1843, Trans. Zool. soc. Lond., **3**, p. 18.
Prionodon cucuri Castelnau, 1855, Anim. nouv., Poiss., p. 99.
Isogomphodon maculipinnis Poey, 1866, Repertorio, **1**, p. 191, 450, pl. 4, f. 3, 4; 1868, ibid., **2**, p. 245, pl. 2, f. 1–3.
Carcharias maculipinnis Günth., 1867, Trans. Zool. soc. Lond., **6**, p. 490.
Carcharias (*Prionodon*) *mülleri* Steindachner, 1867, Sitzb. Akad. wiss. Wien, **56**, p. 356.
Carcharias ehrenbergi Klunzinger, 1871, Syn. fische, **2**, p. 221.
Carcharias aethalorus Jord. & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 104.
Isogomphodon limbatus Jord. & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 23.
Carcharinus (*Isogomphodon*) *limbatus* Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 40.
Carcharinus (*Isogomphodon*) *aethalorus* Jord. & Everm., 1896, ibid.
Carcharias limbatus Ribeiro, 1907, Arch. Mus. nac., **14**, p. 153, pl. 3; Günth., 1910, Südsee fische, **3**, p. 481.

Body compressed; head broader than high, tapering from the gills; snout elongate, rather narrowly rounded at the end, length nearly two lengths of the mouth, which is little more than the width of the latter, or about five sixths of the distance from the eye to the first gill opening. Nostrils smaller than the eye, more than half way from the end of the snout to the orbit. Eye small, diameter nearly one third of the length of the mouth, front edge of the orbit on a level with that of the latter, nictitating membrane below. Gill openings large, width equal length of mouth, hindmost one above the pectoral base. Mouth large, much arched, with a short labial fold at the angle, slightly extended forward on each jaw and bearing a short groove behind it. Teeth almost erect, in $\frac{34}{31}$ rows; bases broad; cusps narrow; upper serrate on the bases and to some extent on the sides of the cusps; lower not serrate on the cusps and with or without coarse serrations on the bases; median on the upper jaws small; median lower tooth small, and a tooth at each side of it little larger. Pectorals subfalciform, outer angle rather

sharp, inner blunt rounded, width about $\frac{2}{3}$ of the greatest length, reaching below the middle of the dorsal. Dorsal origin above the inner angle of the pectoral, fin not reaching a vertical from the origins of the ventrals by a space as long as the mouth. Ventrals small, about midway between the bases of the dorsals. Second dorsal small, distance from the base of the first equal $\frac{9}{11}$ of the caudal, basal length equal half its distance from the caudal pit, or about the length of the produced hinder angle. Anal little larger than the second dorsal and directly below it, hind margin deeply notched, with two sharp angles. Caudal about $\frac{2}{7}$ of the total, lower lobe produced, pointed. Total length 39, snout to abdominal pores 20, snout to fifth gill opening $9\frac{1}{4}$, snout to mouth $3\frac{1}{8}$, and caudal fin 11 inches.

Back brown, with a black spot on tips of dorsals, pectorals, anal and subcaudal; below white.

Tropical and temperate seas. Specimen described from Rio Janeiro, secured by the Hassler Expedition.

Carcharinus brachyurus.

Carcharias (Prionodon) brachyurus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 369.

Snout moderate, rather pointed, longer than the mouth, length about two thirds of the latter's width, nostrils behind the middle but nearer to the end than to the angles of the mouth. Teeth serrated; upper oblique, deeply notched on the outer margin; lower erect, cusps narrow, lanceolate, bases broad, two-rooted. Gill openings at least twice the width of the eye. Pectorals narrow, pointed, falciform. Dorsal rather nearer to the pectorals than to the ventrals, the distance from the latter being little less than the length of the dorsal base. Second dorsal very small, smaller than the anal. Anal origin opposite that of the second dorsal, midway from ventrals to caudal. Caudal one fourth of the total length. Type seven feet nine inches in length.

Coloration uniform.

New Zealand; Australia.

Carcharinus amblyrhynchus.

Carcharias (Prionodon) amblyrhynchos Bleeker, 1856, Nat. tijds. Ned. Ind., **10**, p. 467; Duméril, 1865, Elasm., p. 364; Günther, 1870, Cat. fishes Brit. mus., **8**, p. 368.

"Carch. (Prion.) corpore elongato compresso, altitudine $7\frac{7}{10}$ circiter in ejus longitudine; capite 5 circiter in longitudine corporis, duplo circiter latiore quam alto; oculis diametro $3\frac{1}{2}$ circiter in longitudine rostri, pupilla oblonga

verticali; rostro acuto parte praeorali rictus longitudine paulo, rictus latitudine multo breviore; linea rostri anteriore subparabolica; naribus rostri apici multo magis quam angulo oris approximatis, valvula trigona brevi; rictu valde lato multo latiore quam longo; dentibus maxilla superiore triangularibus parum obliquis totis denticulatis basi latis basi externe processu denticulis majoribus serrato; dentibus maxilla inferiore gracilibus rectis denticulatis basi latis; angulo oris sulco parvo labio inferiore quam labio superiore paulo longiore. Dorsali prima pectoralibus multo magis quam ventralibus approximata. Dorsali secunda quintuplo circiter ejus longitudinis a dorsali prima remota, dorsali prima triplo circiter humiliore et breviore, longiore quam alta, anali tota opposita apice rotundata acutiuscula; pectoralibus capite vix longioribus $5\frac{3}{5}$ circiter in longitudine corporis paulo minus duplo longioribus quam latis, emarginatis, acutis; anali medio basin caudalis inter et ventrales sita, dorsali secunda multo altiore sed vix latiore; caudali 4 fere in longitudine corporis. Colore corpore superne pinnisque cupreo-coerulescente, inferne albo; pectoralibus inferne albis apice nigricantibus; ventralibus caudalique nigricante marginatis." (Bleeker *loc. cit.*).

Java.

Carcharinus falciformis.

Carcharias (*Prionodon*) *falciformis* Müller & Henle, 1841, Plagíos., p. 47; Duméril, 1865, Elasm., p. 374.
Prionodon falciformis Guichenot, 1855, Peces de Cuba. Sagra's Hist., p. 248, pl. 5, f. 3.
Squalus tiburo Poey, 1860, Memorias Cuba, **2**, p. 331, pl. 19, f. 1, 2; 1868, Repertorio, **2**, p. 172, pl. 4, f. 18.
Platypodon tiburo Poey, 1868, ibid., p. 448.
Platypodon falciformis Poey, 1868, ibid., p. 449, pl. 4, f. 18; 1876, An. Soc. Esp. hist. nat., **5**, p. 191.
Carcharinus falciformis Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 36.

Snout and shapes of body and fins as in *C. menisorrah*. Nostrils hardly half of the diameter of the eyes, orbits oblong. Teeth in 30 rows; upper oblique, with a notch and a strongly denticulate basal process; lower without or with faint serrations, cusp narrower, on a broad base; median paired. Pectorals moderate, falciform, hind margin deeply concave. First dorsal nearer to the pectorals than to the ventrals, outer angle rounded, hinder pointed, hind margin deeply indented. Second dorsal small, directly above the anal. Anal little larger than the second dorsal, hind margin deeply notched, acuminate extremity reaching little more than half way from the base to the caudal. Caudal more than one fourth of the total, lower lobe prominent.

Greyish brown; lower surfaces light.

West Indies.

Carcharinus velox.

Carcharinus velox Jordan & Everman, 1898, Bull. 47, U. S. nat. mus., p. 2747.
Carcharias velox Gilbert & Starks, 1903, Mem. Cal. acad. sci., **4**, p. 9, pl. 1, f. 3.

Head long, one fourth of the total, rather narrow and pointed, depressed. Snout elongate, about two fifths of the head, including the gill openings. Nostrils in the middle of the preoral length, width equal that of orbits or the distance from the eye, narial valve without a pointed lobe. Mouth large, much arched, width less than length of snout, length two thirds; labial fold a short groove on the upper jaw at the angle, directed out and forward. Upper teeth subtriangular, oblique, deeply notched on the outer edge, serrated; lower broad based with narrow cusps and fine serrations visible under a lens. Pectorals subfalciform, width hardly two thirds of the length, pointed, reaching behind the base of the dorsal, hind margin deeply concave, inner extremity somewhat produced, rounded on the angle. First dorsal nearer to the pectoral than to the anal, origin at a little distance behind the base of the pectoral, hind margin deeply excavated, angle produced, base about two fifths of its distance from the second dorsal. Second dorsal directly opposite the anal but smaller, origin slightly farther back, hind margin nearly straight. Anal little larger than second dorsal, hind margin deeply indented. Caudal more than one fourth of the total, pointed, greatest depth less than half the caudal length; subcaudal lobe produced, blunted.

Greyish brown; white below.

Panama.

Carcharinus obscurus.

Squalus obscurus Lesueur, 1818, Journ. Acad. nat. sci. Phil., **1**, p. 223, pl. 9; Gill, 1861, Proc. Acad., nat. sci. Phil., p. 59 extra.
Carcharias falcipinnis Lowe, 1839, Proc. Zool. soc. Lond., p. 90; 1843, ibid., p. 93; 1843, Trans. Zool. soc. Lond., **3**, p. 18.
Carcharias (*Prionodon*) *obscurus* Müller & Henle, 1841, Plagios., p. 46; Duméril, 1865, Elasm. p. 371; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 366.
Carcharias obscurus DeKay, 1842, N. Y. fish., p. 350, pl. 61, f. 201; Storer, 1867, Mass. fish., p. 243, pl. 36, f. 2.
Prionodon obvelatus Valenciennes, 1843, Ichth. Canar., p. 103, pl. 26; Duméril, 1865, Elasm., p. 376.
Platypodon obscurus Gill, 1864, Proc. Acad. nat. sci. Phil., p. 262.
Carcharinus obscurus Jord. & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 22.
Carcharinus (*Platypodon*) *obscurus* Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 35.

Body moderately stout and long, the cavity extending slightly behind the mid length. Head depressed, much broader than deep; crown convex; snout broad, broadly rounded in front of the nostrils. Outer angle of nostril nearer to the eye than to the end of the snout. Eye small, hardly one third of the oral length. Mouth large, width greater than the preoral length, length three fifths

of the width; labial folds very short, in the angle, on both jaws. Teeth serrated, in $\frac{30}{28}$ rows, median two in the upper series very small; upper teeth broader, oblique with an indentation on the outer edge; lower more erect, with broad bases and lanceolate cusps. Gill openings about twice the width of the orbit, two above the base of the pectoral. Pectorals nearly twice as long as wide, falciform, pointed, reaching backward as far as the end of the base of the dorsal. Dorsal origin little forward of the inner angle of the pectoral, base length equal the width of the mouth or more than one third of the distance from the second dorsal, hind margin concave, end of fin distant from a vertical at the origin of the ventral about half the total length of the dorsal. Second dorsal small, base one third as long as that of the first and above the middle of the anal base. Ventrals larger than the anal, with blunted angles. Anal larger than the second dorsal, base longer, equal half the distance from the caudal pit, hind margin deeply notched. Caudal more than one fourth of the total length, little longer than the distance between the dorsals, end pointed, subcaudal lobe prominent.

Back greyish brown; lower surfaces whitish.

Total length 40, snout to abdominal pores $21\frac{3}{4}$, snout to fifth gill opening 9, snout to mouth 3, and caudal fins $11\frac{1}{4}$ inches.

Specimens described from Buzzards Bay, Massachusetts, collected by S. Garman.

Northern and Middle Atlantic.

Carcharinus porosus.

Carcharias porosus Ranzani, 1839, Novis spec. piscium, **1**, p. 8, pl. 2; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 153.

Carcharias (*Prionodon*) *porosus* Duméril, 1865, Elasm., p. 373; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 365.

Carcharias (*Prionodon*) *henlei* Müller & Henle, 1841, Plagios., p. 46, pl. 19, f. 6 (teeth).

Snout broad, broadly rounded from the nostrils, blunt at the end, rostral cartilages strong and rigid. Nostrils at the hinder two fifths of the snout, as far from the end as from the eye, with a short point on the valve. Eye small, nearer to the first gill opening than to the end of the snout. Mouth medium, length nearly half that of snout, more than half the width. Teeth serrate, varying in individuals as to amount of serration; upper broader in the cusp, more erect near the median, oblique toward the angles, sharply notched above the base on the outer edge; lower narrowly triangular, erect near the symphysis, oblique outward with a sharp notch; rows $\frac{29}{29}$. Width of gill openings equal length of orbit. Pectorals broad, reaching below the greater part of the dorsal base, outer angle blunted, hind margin concave. Dorsal origin little forward

of the inner extremity of the pectoral, base two fifths of the distance from the second dorsal, hind margin concave. Second dorsal much smaller than the anal, origin above the hindmost fourth of the anal base, acuminate end reaching half way to the caudal pit and somewhat farther back than the end of the anal fin. Anal farther forward than second dorsal, base equal half the distance from the caudal, hind margin deeply excavated. Ventrals small, angles rounded, base in front of the middle of the space between the dorsals. Caudal about one fourth of the total length, angles blunted, subcaudal lobe hardly half the depth of the fin.

Back brown, edges of caudal darker; lower surfaces white, edges of fins and hind edge of subcaudal lobe white.

By some authors *C. fissidens* Bennett, 1830, Proc. Zool. soc. Lond., p. 148, is placed as a doubtful synonym of this species.

West Indies; Brazil.

Carcharinus sorrah.

Carcharias (*Prionodon*) *sorrah* Müller & Henle, 1841, Plagios., p. 45, pl. 16; Bleeker, 1852, Verh. Bat. gen. **24**, Plagios., p. 39; 1853, Verh. Bat. gen., **25**, p. 80; Duméril, 1865, Elasm., p. 368; Kner, 1867, Nov. fische, p. 414; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 367; Day, 1878, Ind. fishes, p. 711, 714, pl. 185, f. 1.
Isoplagiodon sorrah Gill, 1861, Ann. N. Y. lyc., **7**, p. 410 (name only).
Carcharias phorcys Jord. & Everm., 1903, Bull. U. S. fish. comm., **22**, p. 163; 1905, ibid., **23**, p. 39, pl. 2.
Carcharias sorrah Günth., 1910, Südsee fische, **3**, p. 480.

Snout of moderate length, broadly curved on the sides, blunt. Nostrils about midway in the preoral length, greatest diameter about two thirds that of the orbit, valves with a pointed lobe. Mouth medium, strongly arched, width nearly equal preoral length of head. Teeth broad and inclined outward above and below, in 25 rows, notched on the outer edge, with stronger denticles below the notch; serrations varying; median tooth small. Eyes moderate, diameter nearly equal width of gill openings, or half the distance from the nostrils. Pectorals falciform, more than half as broad as long, reaching the end of the dorsal base, outer angle sharp, hinder 90°, hind margin concave. Origin of first dorsal little behind base of pectorals, base much farther from the ventrals. Ventrals small, nearly opposite the middle of the space between the bases of the dorsals. Second dorsal small, base above the hinder half of that of the anal. Anal twice as large as the second dorsal and ending opposite that fin, hind margin deeply notched, hinder angle much produced, not reaching the caudal. Caudal long, nearly two sevenths of the total, pointed, subcaudal lobe deep, sharp.

Brown, lighter below, subcaudal and pectorals blackish on the tips.

Indian Seas; Madagascar; Borneo; Java.

Carcharinus milberti.

Carcharias (Prionodon) milberti Müller & Henle, 1841, Plagios., p. 38, pl. 19, f. 3, (teeth); Duméril, 1865, Elasm., p. 360; Doderlein, 1881, Man. ittiol. Medit., **1**, p. 44.
Carcharias ceruleus De Kay, 1842, N. Y. fish., p. 349, pl. 61, f. 200.
Lamna caudata DeKay, 1842, ibid., p. 354, pl. 62, f. 205.
Squalus milberti Nardo, 1853, Sopra spec. pesci., p. 15.
Eulamia milberti Gill, 1864, Proc. Acad. nat. sci., Phil., p. 262.
Eulamia nicaraguensis Gill & Bransford, 1877, Proc. Acad. nat. sci. Phil., p. 190.
Carcharias nicaraguensis Lütken, 1880, Vid. medd. nat. forh., p. 21 extr., fig.
Eulamia coeruleus Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 245.
Carcharias fronto Jordan & Gilbert, 1882, ibid., p. 102.
Carcharias coeruleus Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 872.
Carcharinus milberti Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 22; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 37.
Carcharias plumbeus Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 872.
Carcharinus nicaraguensis Jordan, 1887, Proc. U. S. nat. mus., **9**, p. 556; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 39.
Carcharias milberti Moreau, 1891, Poiss. France Suppl., p. 2; Pietschmann, 1906, Ann. k. k. nat. Hofmuseums, **21**, p. 133 extra.
Carcharinus fronto Jord. & Everm., 1896, Bull. 47 U. S. nat. mus., p. 39.
Carcharias azureus Gilbert & Starks, 1903, Mem. Cal. acad. sci., **4**, p. 11, pl. 2, f. 5.

Snout rather short and broad, rounded and blunt, longer than the mouth but nearly equal to its width. Nostrils about midway in the preoral length, their width and the length of the orbit nearly equal. Teeth serrated, in 25–29 rows; upper broader, with cusps directed somewhat obliquely outward, becoming more oblique toward the angles and bearing a notch on the outer edge; lower narrow, erect, with a broad base and fine serrations; median upper small and serrated, lower entire. Pectorals longer than broad, two thirds as wide as long, subfalciform, outer angle rounded, hind margin somewhat concave. Origin of dorsal slightly behind the end of the base of the pectoral, base extending back over nearly half the distance to the ventrals, upper angle rounded, hind border concave. Second dorsal and anal subequal, acuminate behind, origin of the former slightly forward, both angles of the anal sharp and hind margin deeply indented. Caudal nearly one fourth of the total length.

Greyish brown; lighter below.

Middle Atlantic, and Middle Eastern Pacific.

The type was taken off the Coast of New York; Duméril reported the species from the Mediterranean, and Doderlein, 1881, published an extensive list of authorities and synonyms.

Off the coasts of the eastern United States to the Caribbean, entering fresh waters; it is rather common.

Carcharinus amboinensis.

Carcharias (Prionodon) amboinensis Müller & Henle, 1841, Plagios., p. 40, pl. 19, f. 4; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 372.

This species differs from *C. milberti* principally in the form of the teeth and the pectoral fins. Snout obtusely rounded. Teeth moderate, subequal in form and size in the two jaws, broad, triangular, serrated, in 25 rows. The upper are slightly oblique, the lower more erect, the laterals have greater indentation on the outer edge, and the median are shaped like the larger ones at each side of them but are very small and the lower one is not serrated. Pectorals longer than those of *C. milberti*, with sharp outer and rounded hinder angles, and with hind margins deeply indented.

Grey; lighter below.

Amboina.

Carcharinus melanopterus.

Carcharias melanopterus Quoy & Gaimard, 1824, Voy. Uran., Poiss., p. 194, pl. 43, f. 1, 2; Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 63; Günth., 1866, Fishes Zanzibar, p. 142; Klunzinger, 1871, Syn. fische, **2**, p. 218; Jord. & Everm., 1905, Bull. U. S. fish. comm., **23**, p. 38, pl. 1; Jord. & Seale, 1906, Bull. U. S. fish. comm., **25**, p. 182; Günth., 1910; Südsee fische, **3**, p. 480.

Carcharias (Prionodon) melanopterus Müller & Henle, 1841, Plagios., p. 43, pl. 19, f. 5; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 33; Duméril, 1865, Elasm., p. 305; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 369; Day, 1878, Ind. fishes, p. 715, pl. 185, f. 3.

Carcharias (Prionace) melanopterus T. Cantor, 1849, Malay fishes, p. 400.

Carcharias (Prionodon) henlei Bleeker, 1853, Nat. tijds. Ned. Ind., **4**, p. 507.

Carcharias (Prionodon) brachyrhynchus Bleeker, 1854, Act. Soc. sci. Ind. Neerl., **6**, p. 206; Duméril, 1865, Elasm., p. 364.

Carcharias melanopterus Fowler, 1901, Proc. Acad. nat. sci. Phil., p. 325.

Head less than one fourth of the total, broader than deep; snout short, length about equal to width of mouth, broad, broadly rounded from the eyes. Nostrils little nearer to end of snout than to mouth. Mouth wide, length about two thirds of the width. Teeth serrated, in $\frac{25}{25}$ to $\frac{31}{31}$ rows, broad-based; upper cusps wider, inner edge oblique, straight, outer deeply notched; lower cusps narrower, more erect, nearly or quite smooth in young, median and one at each side of it smaller. Labial folds very short, at the angle, with a short groove toward the eye. Eyes small, front edges above the front edge of the mouth, length of orbits little less than their distance from the nostrils, about equal the width of the gill openings. Two gill openings above the bases of the pectorals. Pectorals falciform, outer angle sharp, inner rounded, width less than half the length, extending behind the base of the dorsal, hind margin concave. Origin of the dorsal above the inner angle of the pectoral, end hardly reaching a vertical from the ventral, inner angle produced, hind argin mdeeply concave, base two

fifths of the distance from the second dorsal. Second dorsal and anal much alike in size and outlines, the anal is perhaps a trifle the farther back and the more deeply excavated on the hind margin; in both fins the upper angle is rounded and the hinder produced. Caudal less than one third of the total, subcaudal lobe prominent, extremity pointed.

Back brownish, yellowish to greenish, fins lighter, tipped with black, edges of caudal black; lower surfaces light.

Total length 18, snout to abdominal pores 9, snout to fifth gill aperture 4, snout to mouth $1\frac{1}{4}$, and length of caudal 5 inches.

Specimen described from Apiang, Kingsmills Island, collected by Andrew Garrett.

Carcharinus menisorrah.

Carcharias (Prionodon) menisorrah Müller & Henle, 1841, Plagios., p. 46, pl. 17; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 35, pl. 1, f. 3; Duméril, 1865, Elasm., p. 369; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 371; Day, 1878, Ind. fishes, p. 716, pl. 184, f. 1.
Carcharias (Prionodon) tjutjot Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 36, pl. 1, f. 4; Duméril, 1865, Elasm., p. 371.
Carcharinus cerdale Jord. & Everm., 1898, Bull. 47, U. S. nat. mus., p. 2746.
Carcharias cerdale Gilbert & Starks, 1903, Mem. Cal. acad. sci., **4**, p. 10, pl. 2, f. 4.

Body moderate, cavity nearly half the total length; head about one fourth of the total, depressed; snout obtusely pointed, rounded at the sides from the eyes, preoral length three fourths of the distance from the eye to the first gill aperture. Nostrils little nearer to the mouth than to the end of the snout. Width of mouth little more than length of snout, length of mouth equal two thirds of the width; sides of mouth nearly straight from the angle to the sharp curves near the symphyses. Labial folds in the angle, very short, upper visible and extended outward. Eyes small, length of orbits one half their distance from the nostrils, one fifth of that from the gill opening. Teeth with broad bases, in $\frac{25}{28}$ rows; upper cusps broad, oblique, serrated more coarsely toward the bases, with two or three rather prominent denticles just below the notch on the outer side; lower cusps lanceolate, nearly erect, with minute serrations, varying with age; median teeth little smaller. Gill openings half the width of the mouth. Pectorals two thirds as wide as long, outer angle sharp, hind margin concave, reaching behind the mid length of the base of the dorsal. Origin of dorsal above the inner angle of the pectoral, fin large, base length nearly two fifths of the distance from the second dorsal, upper angle sharp. Second dorsal and anal about equal, bases opposed, hind margins concave, outer angles blunted, ends acuminate, length of bases hardly more than half their distances from the caudal. Ventrals

nearer to the first dorsal than to the anal, outer angles about 90°. Caudal one fourth of the total, pointed, subcaudal lobe more than half the greatest depth.

Back brown, fin margins whitish, second dorsal with a spot of black; lower surfaces whitish.

Total length 30, snout to abdominal pores $15\frac{1}{2}$, snout to fifth gill opening 7, snout to mouth $2\frac{1}{8}$ and caudal fin $7\frac{1}{2}$ inches.

Specimens a female, from Singapore, and a mature male, of 27 inches, from Penang, Capt. W. H. A. Putnam.

Indian Seas; Mauritius; Panama.

Carcharinus acronotus.

Squalus acronotus Poey, 1860, Memorias, **2**, p. 335, pl. 19, f. 3–4.
Platypodon acronotus Poey, 1868, Repertorio, **2**, p. 450; 1876, An. Soc. Esp. hist. nat., **5**, p. 193.
Carcharinus acronotus Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 36.

Snout elongate, moderately pointed. Nostrils nearer to the mouth than to the end of the snout; valves with a long sharp lobe. Eyes medium, vertical diameter equal to the width of the nostrils. Teeth finely serrated, in $\frac{26}{25}$ rows; upper subtriangular, oblique, inner edges slightly sinuous, outer deeply notched; lower with a broad straight base and narrower cusps in outlines resembling those of *Scoliodon terrae novae*. Outer angle of the pectoral rather sharp, inner blunted, hind margin with a shallow indentation. Origin of the first dorsal little behind the inner angle of the pectoral, upper angle sharp, hinder produced, base equal two fifths of its distance from the second dorsal. Hind margin of second dorsal nearly straight, hinder angle produced, base opposite that of the anal. Anal deeply indented on the hind margin. Subcaudal lobe sharp, subfalciform.

Brown.

Cuba.

Carcharinus spallanzani.

Squalus spallanzani Lesueur, 1822, Journ. Acad. nat. sci., Phil., **2**, p. 351.
Carcharias (Prionodon) bleekeri Duméril, 1865, Elasm., p. 367; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 370; Day, 1878, Ind. fishes, p. 711, 715.

Snout somewhat produced, preoral length nearly equal to the length of the mouth, nostrils near the mid length. Teeth finely serrated, in $\frac{25}{23}$ rows; upper oblique, with a notch on the outer edge, inner edge straight; lower more erect, cusp narrower, base broad. Pectorals twice as long as wide, front margin five times the inner, fin falciform, outer angle sharp. Origin of first dorsal little behind the bases of the pectorals, base nearly its length in advance of the bases

of the ventrals. Second dorsal small, above the anal and of equal length but lower, hind angle produced.

Yellowish grey, lighter below, a blackish spot below the end of the pectoral, on the second dorsal, and on the subcaudal lobe. No spot on the first dorsal.

Indian Ocean.

Carcharinus dussumieri.

Carcharias (*Prionodon*) *dussumieri* Müller & Henle, 1841, Plagios., p. 47, pl. 19, f. 8; Duméril, 1865, Elasm., p. 370; Kner, 1867, Nov. fische, p. 414; Günth., 1870, Cat. fishes Brit. mus., p. 367; Day, 1878, Ind. fishes, p. 714, pl. 187, f. 2.

Carcharias (*Prionodon*) *javanicus* Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 38, pl. 2, f. 5; Duméril, 1865, Elasm., p. 369.

Proportions of the body somewhat like those of *C. sorrah*. Snout moderate, bluntly rounded, preoral length little more than width of mouth, nostrils nearly half way from the mouth to the end. Teeth serrated, oblique, in $\frac{25}{28}$ rows; upper with broader cusps, inclined outward above a notch and a strongly denticulate basal process; lower more erect, with smaller cusp on broad base and with less of a notch on the outer side, serrated to the point; median small. Greatest diameter of orbit less than that of the gill openings. Pectoral less than twice as long as broad, subfalciform, outer angle blunted. Dorsal rather high, origin at a short distance behind the pectoral base, fin nearer to the pectorals than to the ventrals. Second dorsal and anal about equal, bases nearly half the length of the base of the first dorsal, hind angles acuminate, reaching about half way from the base to the caudal, hind margin of anal not much indented. These fins are longer than in *C. sorrah* and the bases are more directly opposed.

Greyish brown, with white fin margins, top of second dorsal dark, lower surfaces whitish.

China; India; East Indies.

Carcharinus pleurotaenia.

Carcharias (*Prionodon*) *pleurotaenia* Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 40, pl. 2, f. 6; Duméril, 1865, Elasm., p. 377.

Body elongate, compressed; head tapering, length about one fifth of that of the body. Snout rather produced and pointed, preoral length little less than the width of the mouth; nostrils nearer to the mouth than to the end of the snout, with a small point on the valve. Teeth erect, bases broad, cusps narrower, rows $\frac{29}{30}$; upper cusps rather broader, serrated, lower lanceolate, smooth. Gill openings about three times the width of the eye. Pectorals reaching beyond the end of the dorsal. Dorsal origin close to a vertical from the bases of the pectorals.

Second dorsal and anal about equal, origins opposed. Caudal long, nearly equal to the distance between the origins of the dorsals.

Sides of the tail with a longitudinal band of light color; fins unspotted.

Java.

Carcharinus borneensis.

Carcharias (Prionodon) borncensis Bleeker, 1858, Act. Soc. sci. Ind. Neerl., **5**, p. 8; Duméril, 1865, Elasm., p. 378; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 371.
Carcharinus tephrodes Fowler, 1905, Proc. Acad. nat. sci., Phil., p. 455, f. 1.

"Carcharias (Prionodon) corpore elongato compresso, altitudine $8\frac{1}{2}$ ad 9 in ejus longitudine; capite valde acuto 5 et paulo in longitudine corporis, latiore quam alto; oculis diametro 3 fere in longitudine rostri, pupilla oblonga gracili verticali; rostro antice acutiuscule rotundato, rictus latitudine longiore, parte praeorali rictus longitudine longiore; naribus rostri apici magis quam angulo oris approximatis, oculo minoribus, valvula trigona valde conspicua; rictu valde curvato latiore quam longo; dentibus maxilla superiore symphysealibus 2 minoribus exceptis, oblique trigonis postrorsum spectantibus margine anteriore leviter denticulatis margine posteriore edentulis sed basi processu bi- ad tridentato munitis; dentibus maxilla inferiore symphysealibus 2 minoribus rectis gracilibus basi lata insertis oblique trigonis postrorsum spectantibus denticulis conspicuis nullis oblique basi lata non dentata insertis; angulo oris fossa parva sulcis brevissimis pupilla brevioribus. Pinna dorsali prima pectoralibus magis quam ventralibus approximata, corpore humiliore, latiore quam alta. Dorsali secunda magna parte post pinnam analem sita, plus quintuplo ejus longitudinis a pinna dorsali prima remota, basi longiore quam antice alta, dorsali prima triplo circiter humiliore. Pectoralibus $1\frac{2}{3}$ circiter in longitudine capitis, latitudine $1\frac{1}{3}$ circiter in earum longitudine, emarginatis, apice acute rotundatis. Anali caudali magis quam ventralibus approximata dorsali secunda vix latiore et non altiore. Caudali $3\frac{2}{3}$ and $3\frac{3}{4}$ in longitudine corporis.

Colore corpore superne griseo-cupreo, inferne albido; pinnis coerulescente-griseis, dorsalibus antice nigro marginatis, dorsali prima superne tota fere nigra; caudali postici tota nigro marginata." (Bleeker).

Borneo.

Carcharinus remotus.

Carcharias (Prionodon) remotus Duméril, 1865, Elasm., p. 374.
Platypodon perezii Poey, 1876, An. Soc. Esp. hist. nat. **5**, p. 194, pl. 9, f. 2–3.
Carcharinus perezi, Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 36.

Head broader than deep; snout depressed, rather abruptly narrowed from the nostrils forward, broadly rounded in front, length about one and one half

times that of the mouth. Nostrils small, distance from the eyes less than half that from the end of the snout. Mouth large, width equal length of snout, length about $\frac{2}{3}$ of the width; labial folds at the angle, lower hidden, upper a short gash toward the eye, with a short groove backward. Teeth narrow, erect; serrate edged, on broad bases, in $\frac{31}{29}$, $\frac{34}{31}$ rows, median teeth small varying in number from one to three rows. Gill openings less than twice as wide as the eye, hindmost two above the base of the pectoral. Pectorals subfalciform, outer angle produced, reaching behind the base of the dorsal, inner angle narrow, rounded. Height of dorsal and length of its base about equal, origin above the inner angle of the pectorals midway from end of snout to second dorsal, distance between the base and the origin of the ventrals less than the length of the snout, equal two fifths of the distance from the second dorsal. Second dorsal smaller than the anal and extending very little farther back, origin about over middle of base of anal, length of base equal to half its distance from the caudal. Anal with two angles, outer blunted, hind margin deeply excavated. Caudal long, nearly two sevenths of the total, depth of lower lobe nearly one third of the length, blunted. Space between bases of dorsals equal, near five times the base of the anal, two and one half times that of the first dorsal and more than six times that of the second dorsal.

Back brown, fins with darker edgings, except the hind margin of the pectoral which is white; lower surfaces whitish. No black spots on the fins.

Total length $31\frac{1}{2}$, snout to abdominal pores $16\frac{1}{2}$, snout to fifth gill opening 7, snout to mouth $2\frac{1}{4}$, caudal fins $9\frac{1}{2}$ inches.

Specimens described from Rio Janeiro, taken by the Hassler Expedition.

Carcharinus gangeticus.

Carcharias (*Prionodon*) *gangeticus* Müller & Henle, 1841, Plagios., p. 39, pl. 13; Duméril, 1865, Elasm., p. 359; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 367; Day, 1878, Ind. fishes, p. 715, pl. 187, f. 1; Steindachner, 1900, Denk. Akad. wiss. Wien, **70**, p. 519.

Carcharias (*Prionodon*) *japonicus* Schlegel, 1850, Jap. Pisces, p. 302, pl. 133; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 614.

Head rather short and broad. Snout very short; blunt, length about half the width of the mouth, nearly equal distance between nostrils. Nostrils at the edge of the snout, nearly midway in the preoral length; valves without a pointed lobe. Mouth large, curvature less than that of snout, length hardly half the width; labial fold very short, at the angles. Teeth subtriangular, serrated, in 27–31 rows; upper broad, slightly oblique in front, more so toward the angles, outer teeth with outer edge more indented; lower erect, narrower in the

cusp, broad based, edges serrated and deeply indented above the base, on which in some there is a prominence at the side of a notch; median very small. Eyes small. Pectorals long, shorter than those of *C. lamia*, subfalciform, angles pointed, reaching behind the dorsal base. Origin of first dorsal above end of pectoral base, length of base greater than its distance from the ventrals, upper angle blunted, hinder produced. Second dorsal base about half the length of that of first dorsal, about equal its distance from the caudal, origin little in front of that of the anal. Anal little smaller than the second dorsal, hind ends of bases opposed, angles sharp. Caudal large, subcaudal lobe prominent. Closely allied to *C. commersonii*.

Greyish, lighter beneath.

India; Fiji Islands; Japan.

Carcharinus commersonii.

Squalus sp. Gronow, 1763, Zoophy., **1**, p. 32, no. 143 (syn. in part).
Le squale requin Lacépède, 1798, Poissons, **1**, p. 169 part, pl. 8, f. 2.
Squalus carcharias Risso, 1810, Ichth. Nice, p. 25; Gray, 1854, Gron. syst., p. 5 (part).
Carcharinus commersonii Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 90.
Carcharias lamia Risso, 1826, Hist. nat. **3**, Poissons, p. 119; Günth., 1810, Südsee fische, **3**, p. 481.
Carcharias (Prionodon) lamia Müller & Henle, 1841, Plagios., p. 37, pl. 12; Duméril, 1865, Elasm., p. 356; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 372; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 40.
Carcharias (Prionodon) leucas Müller & Henle, 1841, Plagios., p. 42; Duméril, 1865, Elasm., p. 358.
Squalus longimanus Poey, 1861, Memorias Cuba, **2**, p. 338, pl. 19, f. 9, 10 (teeth).
Prionodon lamia Bocage & Capello, 1866, Plagios., p. 18.
Eulamia longimana Poey, 1868, Repertorio, **2**, p. 448.
Eulamia lamia Jordan & Gilbert, 1881, Proc. U. S. nat. mus., **4**, p. 32; 1883, Bull. 16, U. S. nat. mus., p. 60.
Carcharias obtusirostris Moreau, 1881, Poiss. France, **1**, p. 332.
Carcharias lamiella Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 110; 1883, Bull. 16, U. S. nat. mus., p. 873.
Carcharias sp. incog. Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 107.
Eulamia lamiella Jordan & Bollman, 1889, Proc. U. S. nat. mus., **12**, p. 179; 1895, Proc. Cal. acad. sci., ser. 2, **5**, p. 382.
Eulamia (Platypodon) platyrhynchus Gilbert, 1891, Proc. U. S. nat. mus., **14**, p. 543.
Carcharinus (Platypodon) platyrhynchus Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 36.
Carcharinus lamiella Jord. & Everm., 1896, ibid., p. 37.
Carcharinus lamia Jord. & Everm., 1896, ibid., p. 38.
Carcharias insularum Snyder, 1904, Bull. U. S. fish. comm., **22**, p. 513, pl. 1, f. 13; Jord. & Everm., 1905, Bull. U. S. fish comm., **23**, p. 40, pl. 3, f. 1.
Carcharias nesiotes Snyder, 1904, Bull. U. S. fish. comm., **22**, p. 514, pl. 1, f. 2; Jord. & Everm., 1905, Bull. U. S. fish. comm., **23**, pl. 3, f. 2.

Snout short, broad, blunt, rounded; nostrils near the mid length, about as wide as the orbit. Eyes small, width of orbits nearly half their distance from the nostrils. Mouth large, strongly curved, distance from end of snout nearly equal that between the nostrils, with a short labial groove in each angle. Teeth subtriangular, serrated, in 27–31 rows; upper nearly erect; lower narrower, more

concave on the edges, more erect; bases broad, two-rooted; median teeth small, erect. Width of gill openings more than twice the length of the orbit. Pectorals long, length twice the width or more, reaching beyond the dorsal, angles rounded. Height of first dorsal greater than length of base, origin above the axils of the pectorals, upper angle rounded, hind margin concave, hind angle produced. Second dorsal small, little longer than the anal and little farther forward in origin. Anal small, origin below the forward half of the base of the second dorsal, hind margin deeply excavated, length of base less than its distance from the caudal. Caudal large, less than one third of the total length, subcaudal lobe deep, depth nearly half of the caudal length; hind margin of subcaudal deeply indented, separated from the pointed terminal fin by a shallow notch.

Brown, light or greyish to dark, in cases mottled or spotted with darker; lighter to whitish below. Young darker on tips of fins.

Middle Atlantic and Pacific; Mediterranean.

Carcharinus albimarginatus.

Carcharias albimarginatus Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 64, pl. 18, f. 1.
Carcharias (*Prionodon*) *albimarginatus* Müller & Henle, 1841, Plagios., p. 44; Duméril, 1865, Elasm., p. 366; Günth., 1870, Cat., fishes Brit. mus., 8, p. 370.

Positions of fins and outlines of snout resembling those of *C. lamia*, pectorals narrower. Snout short, rounded, blunt, nostrils nearer to the mouth than to the end. Teeth subtriangular, serrated, in 25–27 rows; upper slightly oblique, notched on the outer margin; lower narrower in the cusp, erect, indented on the outer edge; median small, unserrated. Two gill openings above the pectoral. Pectorals somewhat falciform, reaching the end of the dorsal, narrowly rounded on both angles. Dorsal little nearer to base of pectoral than to ventrals, hind margin deeply concave, origin near the inner angle of the pectoral, hinder angle produced, sharp. Second dorsal about one third of the size of the first, half its base extending back above that of the anal, hind margin straight. Anal smaller than second dorsal, origin below the middle of latter's base, base ending slightly behind that of the same fin, hind margin deeply indented.

Greyish yellow, lighter below, tips and hind margins of the fins pure white.

Red Sea.

Carcharinus glyphis.

Carcharias (*Prionodon*) *glyphis* Müller & Henle, 1841, Plagios., p. 40, pl. 14; Duméril, 1865, Elasm., p. 359; Günth., 1870, Cat. fishes Brit. mus., 8, p. 373.

Body rather stout; head depressed, broadly rounded from the gills. Snout short, blunt, length about equal that of mouth or distance between the nostrils.

Nostrils nearer to eye than to end of snout, valve with a slightly produced and pointed lobe. Mouth large, width nearly twice the length, a short labial fold on the upper jaw at the angle. Teeth moderate, serrated, in 27 rows; upper broader, triangular, slightly oblique, edges hardly indented; lower with broad two-rooted bases and narrow lanceolate cusps that are subcylindrical near the bases and chisel-shaped and serrated at the apices. Median tooth small on both jaws. Eyes small, length of orbit less than half the distance from the nostril, less than half the larger gill openings. Pectoral large, width more than half the length, outer angles blunted, hind margin concave, hind angle reaching below the middle of the dorsal base. Dorsal large, origin above the hind part of the pectoral base, base equal two thirds of its distance from the second dorsal, tip not reaching the ventral origins. Second dorsal above and little forward of the anal. Anal smaller than the second dorsal, hind margin more deeply excavated, base equal the distance from the ventral bases, or from the caudal. Caudal little more than one fourth of the total, pointed, lower lobe produced, about equal the width of the balance of the fin.

Loc.?

Carcharinus ellioti.

Carcharias ellioti Day, 1878, Ind. fishes, p. 716, pl. 189, f. 2.
Carcharias murrayi Günther, 1883, Ann. & mag. nat. hist., ser. 5, **11**, p. 137; Murray, 1884, Ann. & mag. nat. hist., ser. 5, **13**, p. 349; Day, 1888, Ind. fishes, suppl., p. 809.

Length of snout less than the width of the internarial space. Nostrils nearly equidistant from the end of the snout and from the mouth. Upper teeth finely serrated, anterior equilateral, rather longer than broad, hinder oblique, concave on the outer edge. Lower teeth in 29 rows, smooth-edged, lanceolate, but with a distal swelling, somewhat as in *C. glyphis*, and with two-rooted bases. Pectoral large, length greater than that from first gill opening to end of snout; length of hind margin only one fourth of that of the front edge. First dorsal origin opposite or close behind the axil of the pectoral. Second dorsal one third as large as the first, larger than the anal. Anal small, origin behind that of the second dorsal. Caudal moderate, length little more than the interdorsal space.

Uniform brownish, top of first dorsal apparently blackish.

Total length of type described $80\frac{1}{2}$, snout to anal 52, snout to dorsal $24\frac{1}{2}$, snout to second dorsal 50, snout to pectoral 18, and length of caudal 20 inches.

Seas of India.

Carcharinus temminckii.

Carcharias (*Prionodon*) *temminckii* Müller & Henle, 1841, Plagios., p. 48, pl. 18; Duméril, 1865, Elasm., p. 378; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 374; Day, 1878, Ind. fishes, p. 717.

Squalus (Carcharias) temminckii Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 36.
Lamiopsis temminckii Gill, 1861, Ann. N. Y. lyc., **7**, p. 410 (name only).

Head rather pointed, depressed. Snout moderate, length about equal to width of mouth or to width across the nostrils, rounded at the end. Nostrils behind the mid length of the snout; valve with a pointed lobe of some prominence. Greatest diameter of the orbit much less than the width of the gill openings. Mouth strongly arched, with a short labial fold at the angle. Teeth in $\frac{36-38}{38-41}$ rows, serrated, subtriangular, erect, basal width less than length from apex in the upper series; lower smaller, with narrower to awl-shaped cusps on broad bases, unserrated; median small, in one to three rows. Toward the angles of the mouth the teeth are very small; their cusps are short and broad. Pectorals broad, little longer than wide, subtriangular, reaching below the middle of the dorsal, outer angle sharp, inner rounded, hind margin slightly concave. First dorsal midway between pectorals and ventrals, hind margin not greatly indented. Base of second dorsal three fourths as long as that of the first and less than half of the distance between the two, fin larger than the anal. Anal small, base much shorter and below the middle of that of the second dorsal, hind margin slightly concave. Caudal pointed, length about one fourth of the total, rather deep but subcaudal lobe not greatly developed.

Yellowish brown; lower surfaces yellowish white.

Indian Seas.

Carcharinus oxyrhynchus.

Carcharias (Prionodon) oxyrhynchus Müller & Henle, 1841, Plagios., p. 41, pl. 15; Duméril, 1865, Elasm., p. 356; Günther, 1870, Cat., fishes Brit. mus., **8**, p. 375.
Isogomphodon oxyrhynchus Gill, 1861, Ann. N. Y. lyc., **7**, p. 410 (name only).

Snout long, pointed, straight on the sides. Nostrils nearer to mouth than to end of snout, separated by about a half length of the snout; valves blunt, small. Labial folds on both jaws, short. Orbit narrower than the nostrils. Teeth alike in the two jaws, narrow, erect, in 46–49 rows, lower little more slender, upper serrated near the apices. Gill openings moderate, one opening above the pectoral. Pectorals large, one half longer than broad, reaching beyond the dorsal, hind margin little concave, angles rounded. Dorsal origin above the end of the pectoral base, tip not reaching the ventrals. Second dorsal little larger than the anal, origin farther forward, end reaching half way from base to caudal. Anal smaller than second dorsal, base wholly below the dorsal base, fin less than half the length of first dorsal, more deeply indented on the hind margin than on either dorsal. Scales minute, tricarinate.

Greyish brown; white below.

Off eastern coasts of South America.

Carcharinus munsing.

Carcharias (*Prionodon*) *munsing* Bleeker, 1849, Verh. Bat. gen., **22**, p. 16; 1852, Verh. Bat. gen., **24**, Plagios, p. 32, pl. 1, f. 2; Duméril, 1865, Elasm., p. 354; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 365.

Head pointed, one fifth or more of the total length, broader than high. Snout moderate, depressed, broadly rounded from behind the orbits, length less than the width of the mouth, nostrils little behind the mid length. Nasal valve with a sharp pointed lobe. Diameter of orbit about one sixth of the preoral length. Mouth large, much arched, length about two thirds of the width, a short labial groove at the angle. Upper teeth serrated, rather broad, triangular, nearly erect; lower erect, not serrated, cusp narrow, lanceolate, base broad. Pectorals longer than broad, angles rounded. First dorsal nearer to ventrals than to the bases of the pectorals, more than twice its base from the second dorsal. Second dorsal smaller than the first, little larger than the anal. Anal origin opposite that of the second dorsal. Caudal one fourth or more of the total length.

Brownish, lighter below, fins unspotted.

Java.

Carcharinus maou.

Squalus (*Carcharias*) *maou* Lesson, 1830, Voy. Coquille, Poiss., p. 91, pl. 1; Duméril, 1865, Elasm., p. 379.

Carcharias (*Prionodon*) *maou* Müller & Henle, 1841, Plagios., p. 44.

Body rather stout forward, head short. Snout short, somewhat depressed, bluntly rounded, nostrils near the mid length. Teeth triangular, smooth. Pectorals much longer than broad, angles rounded, hind margin concave. First dorsal nearer to the pectorals than to the ventrals, upper angle rounded, hinder produced, hind margin deeply indented. Second dorsal small, origin above end of anal. Anal smaller than second dorsal, and farther forward. Ventrals nearly below the middle of the space between the dorsals. Caudal elongate, subcaudal lobe prominent.

Vivid bluish green; dorsals, pectorals, ventrals, anal, and subcaudal lobe whitish near their outer angles; lower surfaces white.

Müller and Henle place this species in their subgenus Prionodon, which probably is the better place for it, the statement of the original describer, that the teeth are smooth, notwithstanding.

Society Islands.

Galeus.

Galeus Valmont, 1768, Dict. hist. nat., **1**, p. 371.

Body comparatively slender, tapering to head and tail. Head depressed, snout elongate. Eyes lateral with nictitating membrane well developed. No spiracles. Nostrils oblique. Mouth inferior, greatly arched, with rudimentary labial folds. Teeth curvilinear triangles, with serrated edges and broad bases. Pectorals large, long in the outer angle, hinder angle short. Dorsals, ventrals and anal small. First dorsal nearer to ventrals than to pectorals, second dorsal opposed to the anal. A pit in front of the caudals above and below. Caudals narrow, pointed; subcaudal lobe prominent. Scales minute, with broad tricarinate crowns.

Temperate and tropical seas.

Galeus glaucus.

Plate **3**, fig. 1–3.

Galeus glaucus Rondelet, 1554, Pisc., p. 378; 1558, Hist. poiss., p. 296; Gesner, 1558, Aquat., p. 718; Aldrovandi, 1613, Pisc. & Cet., p. 394; Will., 1686, Pisc., p. 49; Valmont, 1768, Dict. hist. nat., **1**, p. 371; Duhamel, 1777, Traité, **3**, sect. 9, p. 298, pl. 19, f. 6.

Squalus sp. Artedi, 1738, Ichthyologia, Syn., p. 98, Gen., p. 69, no. 13.

Squalus glaucus Linné, 1758, Syst., **1**, p. 235; 1766, Syst., **1**, p. 401; Bloch, 1784, Fische Deutschl., **3**, p. 78, pl. 86; Bonnaterre, 1788, Ichth., p. 9, pl. 7, f. 22; Gmelin, 1789, Linné Syst., **1**, p. 1496; Lacépède, 1798, Poissons, **1**, p. 213; Schn., 1801, Bloch Ichth., p. 131; Turton, 1806, System, **1**, p. 916; Risso, 1810, Ichth. Nice, p. 26; Jenyns, 1835, Man., p. 499; Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 50, f. 2.

Blue Shark Brookes, 1763, Nat. Hist., **3**, Fishes, p. 30; Pennant, 1769, Zool., **3**, p. 84; 1776, Zool., **3**, p. 95; 1812, Zool. **3**, p. 143; Watson, 1778, Philos. trans., **68**, p. 789, pl. 12; Couch, 1867, Brit. fishes, **1**, p. 28, pl. 6.

Le Glauque Broussonet, 1780, Mém. Acad. roy., p. 665.

Charcharias glaucus Rafinesque, 1810, Indice, p. 45.

Carcharias glaucus Cuv., 1817, Reg. anim., **2**, p. 126; Fleming, 1828, Brit. anim., p. 167; Agassiz, 1835, Rech. poiss. foss., **3**, pl. F, f. 1, teeth; Yarrell, 1836, Brit. fishes, **2**, p. 381; Gay, 1854, Hist. Chile, **2**, p. 364; Day, 1884, Brit. fishes, **2**, p. 289, pl. 152; Günther, 1910, Südsee fische, **3**, p. 479.

Squalus (*Carcharinus*) *glaucus* Blainv., 1830, Poiss. Fr., p. 92, pl. 23.

Squalus (*Carcharinus*) *caeruleus* Blain., ibid., p. 90.

Carcharias (*Prionodon*) *glaucus* Müller & Henle, 1841, Plagios., p. 36, pl. 11; Duméril, 1865, Elasm., p. 353; Bocage & Capello, 1866, Plagios., p. 17; Günth., 1870, Cat. fish. Brit. mus., **8**, p. 365; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 42; Day, 1884, Brit. fishes, **2**, p. 289, pl. 152.

Carcharias (*Prionodon*) *hirundinaceus* Duméril, 1865, Elasm., p. 354.

Carcharinus glaucus Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 22.

Prionace glauca Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 33, pl. 4, f. 16; 1905, Bull. U. S. fish. comm., **23**, p. 37, f. 3; Snyder, 1904, Bull. U. S. fish. comm., **22**, p. 515; Jordan & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 613.

Body elongate, subfusiform. Head less than one fourth of the total length, snout long, pointed. Nostrils nearer to mouth than to end of snout. Mouth crescent-shaped, with short labial folds hidden in the angles. Teeth large, in 29–31 rows, those of each series alternating so as to present a continuous cutting

edge, each tooth curved outward to present the inner edge for the vertical cutting, both edges strongly serrated; median tooth smaller, asymmetrical, hooked. Teeth less curved in young. Gill openings five, subequal, width twice that of the eye, hindmost two above the pectoral. Pectorals long, reaching the dorsal, narrow, pointed, inner angle short, rounded. Dorsal entirely in front of mid length, longer than high, hind angle acute, base about two thirds as long as the snout, equal to one third of the distance from the second dorsal. Second dorsal little smaller than the anal, base nearly half as long as that of the first dorsal and above that of the anal but extended a trifle farther backward, hind angle much produced. Ventrals small, half as large as the first dorsal, nearly straight on the hind margins. Anal small, base more than half its distance from the caudal, hind margin deeply notched, hind angle acute. Tail slender, caudal fins moderate, acuminate at the end, subcaudal lobe produced, acute, fin narrowed backward.

Back dark blue or bluish black; whitish below.

Specimen described from Japan, secured by Mr. Alan Owston. Total length 54, snout to abdominal pores 30, snout to fifth gill aperture $12\frac{1}{2}$, and snout to mouth 5 inches. Specimen figured, on Plate 3, much larger, from Massachusetts Bay, secured by Prof. L. Agassiz.

Thalassorhinus.

Thalassorhinus Müller & Henle, 1841, Plagios., p. 62.

Trunk elongate, fusiform; head depressed. Mouth large greatly arched. Teeth subtriangular, denticulate. Nasal valve short. Eye moderate, with a nictitating membrane, pupil vertical. Spiracle medium. Caudal as in Galeus, a notch behind the subcaudal, a caudal pit above and another below.

Snout rather pointed

anal exactly below the second dorsal . . . *rondeletii* (page 146)

Snout broad, rounded at the end

anal below the end of the second dorsal . . *platyrhynchus* (page 147)

Thalassorhinus rondeletii.

Squalus rondeletii Risso, 1810, Ichth. Nice, p. 27.

Carcharias rondeletii Risso, 1826, Hist. nat., **3**, Poissons, p. 120.

Thalassorhinus vulpecula Müller & Henle, 1841, Plagios., p. 62; Duméril, 1865, Elasm., p. 396; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 378.

Thalassorhinus rondeletii Gray, 1851, Chondropterygii, p. 55; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 38.

Thalassinus rondeletii, Moreau, 1881, Poiss. France, p. 319.

Resembling the Blue Shark, *Galeus glaucus*, somewhat in shape and dentition but readily distinguished by the spiracles. Snout moderate, pointed. Nostrils midway in the preoral length. Spiracle about one diameter of the eye behind the orbit and half as much in width. Teeth serrated, in 26 rows, subtriangular, upper broader, more oblique, edges somewhat curved toward the angles of the mouth, as in *G. glaucus*; lower more pointed, more slender, more erect, with finer serratures, edges concave. Pectoral one fifth as long as the body, falciform, rather small, three times as long as wide, outer angle sharp, inner about 90°. Dorsal between the pectorals and the ventrals, nearer the latter, angles sharp, hind margin concave. Second dorsal a little more than half as long as the first, lower than long, upper angle blunt, hind margin nearly straight. Anal equal the second dorsal, exactly below it, with two sharp angles, hind margin deeply indented. Caudal one fourth of the total length, lower lobe produced to nearly one third of the length of the supracaudal. Reaches the length of six feet.

Bluish gray; below white.

Mediterranean and Atlantic.

Thalassorhinus platyrhynchus.

Squalus platyrynchus Walbaum, 1784, Schr. Gesellsch. nat. freunde, Berlin, **5**, p. 381; 1792, Artedi p. 521.

Thalassorhinus platyrhynchus Müller & Henle, 1841, Plagios., p. 63; Gray, 1851, Chondropterygii, p. 55; Duméril, 1865, Elasm., 396; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 379.

Trunk fusiform. Snout broader than long, depressed, rounded in front. Nostrils nearer to the mouth than to the end of the snout. Spiracle small, behind the eyes. Teeth serrated, oblique; upper large, triangular, oblique, cusps sword-shaped; lower smaller, narrower, more erect, cusps awl-shaped on broad bases. Gill openings narrower backward. Pectorals falciform, elongate. Dorsal above the space between the pectorals and the ventrals, hind margin deeply concave. Second dorsal shaped like the first, smaller. Ventrals triangular, longer than broad. Anal opposite the end of the second dorsal, deeply indented on the hind margin. Supracaudal long, axis somewhat raised, subcaudal lobe produced, half as long as the entire caudal. Type six feet in length.

Back greyish with some longitudinal stripes and spots of blackish; lower surfaces whitish.

Locality?

Galeocerdo.

Galeocerdo Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 115; 1837, Wiegm. archiv., p. 397; 1841, Plagios., p. 59.

Body stout, elongate, head depressed, snout short, broad. Mouth large, greatly arched. Labial folds on both jaws. Teeth alike in both jaws, compressed, subtriangular, oblique, more flattened on the outer side and swollen on the inner, denticulate on the edges and the edges of the denticles serrated, deeply notched on the outer edge and convex on the inner. Spiracles small, behind the orbit. First dorsal above the space between the pectorals and the ventrals; second dorsal above the anal. Caudals elongate with pits above and below at the origins. A nictitating membrane. Numerous species occur in the early Tertiaries.

Galeocerdo arcticus.

Plate **43**, fig. 6–8, (brain).

Le squale milandre Lacépède, 1789, Poissons, **1**, p. 237, pl. 8, f. 4 (jaws).
Squalus arcticus Faber, 1829, Fische Islands, p. 17; Nilsson, 1832, Prodromus, p. 115.
Galeus sp. Agassiz, 1835, Rech. poiss. foss., **3**, pl. E, f. 5, 6; Owen, 1845, Odont., pl. 28, f. 9.
Galeus maculatus Ranzani, 1839, Novis spec. piscium, **1**, p. 7, pl. 1; 1840, ibid., **4**, p. 68, pl. 8.
Galeocerdo tigrinus Müller & Henle, 1841, Plagios., p. 59, pl. 23; Gray, 1851, Chondropterygii, p. 54; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 36; Gill, 1864, Proc. Acad. nat. sci. Phil., p. 263; Duméril, 1865, Elasm., p. 393; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 378; Day, 1878, Ind. fishes, p. 718; Jord. & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 21; 1896, Jord. & Everm., Bull. 47, U. S. nat. mus., p. 32; Jord. & Snyder, 1904, Proc. U. S. nat. mus., **27**, p. 940.
Galeocerdo arcticus Müller & Henle, 1841, Plagios, p. 60, pl. 24; Kröyer, 1853, Danm. fiske, **3**, p. 933; Nilsson, 1855, Fisk. Skand., **4**, p. 717; Duméril, 1865, Elasm., p. 394; Günth, 1870, Cat. fishes Brit. mus., **8**, p. 377.
Carcharias (*Prionodon*) *fasciatus* Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 37.
Boreogaleus arcticus Gill., 1861, Ann. N. Y. lyc., **7**, p. 411 (name only).
Galeocerdo maculatus Poey, 1868, Repertorio, **2**, p. 453; 1876, An. Soc. Esp. hist. nat., **5**, p. 201, pl. 9, f. 7.
Galeocerdo rayneri Macdonald & Barron, 1868, Proc. Zool. soc. Lond., p. 368, pl. 32; Günth, 1870, Cat. fishes Brit. mus., **8**, p. 377; Day, 1878, Ind. fishes, p. 718, pl. 187, f. 3.
Galeocerdo obtusus Klunzinger, 1871, Syn. fische, **2**, p. 664.
Galeocerdo fasciatus Kampen, 1907, Bull. Dept. agric. Ind. Neerl., **8**, p. 9.

Body massive, somewhat compressed and elongate; head much broader than high; snout very short and broad, outline from the eyes nearly semicircular. Internarial distance greater than length of snout; nasal valve short, with a small rounded lobe. Eye moderate, orbit longer than wide, pupil rounded. Spiracles small, elongate, behind the orbit on a level with the top of the eye. Mouth large, length nearly two thirds of the width, much more than the length of the snout. A long labial fold on the upper jaw, on the young appearing as if doubled, lower fold much shorter. Teeth alike on both jaws, in 21–25 rows, bases broad, cusps broad, oblique, inner edge convex, inclined outward, outer edge deeply notched, edges denticulate, denticles with fine serrations. Nictitating membrane

below the eye, front end little higher. Pectorals large subfalciform, angles blunted, hind margin concave. Dorsal origin a short distance behind the base of the pectoral, upper angle sharp, hinder produced. Ventrals small, nearer to the second dorsal than to the first. Second dorsal and anal subequal, former slightly in advance of the latter, hind margin nearly straight; anal little smaller and extending little farther back, hind margin deeply notched, base distant twice its length from the caudal pit. Caudal long, slender, pointed, subcaudal lobe produced, sharp, length of fin varying from about one third of the total in the young to one fourth or less in adults. The number of rows of teeth also varies among individuals; some large ones at hand have but 21 rows while others, and much smaller, have 25 or 23 rows. The measurements of a very small specimen are total length 23, snout to hindmost gill opening $4\frac{3}{8}$, snout to abdominal pores $10\frac{3}{4}$, and caudal fins $8\frac{1}{2}$ inches.

Young light brownish with numerous irregular spots of darker along the sides of body and fins, the spots fusing more or less into vertical bars on the sides or transverse bars on the fins, the markings fading with age as the brown darkens until the appearance is uniform greyish brown.

Tropical and temperate seas, to 70° degrees or more from the equator.

Hemigaleus.

Hemigaleus Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 45.

Form elongate, slender. Head depressed, flattened below. A small spiracle. A nictitating membrane. Mouth with distinct labial folds. Teeth unlike; upper oblique, with denticles on the basal part of the outer edge; lower more erect, with a narrow cusp on a broad base, without denticles. First dorsal opposite the space between pectorals and ventrals. Tail with caudal pits, a notch behind the subcaudal fin and a prominent subcaudal lobe. Spiral valve of intestine with comparatively few transverse turns.

Snout broadly rounded
- gill openings less than the length of the orbit
  - caudal longer than the space between the dorsals *pectoralis* (page 150)
- gill openings wider than the orbit
  - caudal equal the interdorsal space . . *microstoma* (page 151)

Snout tapering, rather pointed
- gill openings much wider than the orbit
  - caudal equal the interdorsal space . . *macrostoma* (page 151)
- gill openings twice the width of the orbit
  - caudal shorter than the interdorsal space . *balfouri* (page 152)

Hemigaleus pectoralis.

Plate **4**, fig. 1–5; Plate **50**, fig. 9, (eye); Plate **52**, fig. 2, (pelvis); Plate **58**, fig. 4, (intestine).

Hemigaleus pectoralis Garman, 1906, Bull. M. C. Z., **46**, p. 203.

Outlines in general, positions, and shapes of fins, etc., resembling those of *Galeorhinus mustelus* or *Eugaleus galeus*. Head less than one fourth of the total length, little less than half the body cavity, depressed, broader than high; snout depressed, blunt edged at the sides, broadly rounded from the nostrils forward, blunt at the end. Nostrils midway in the preoral length, large, with a fold on the middle of the front edge from which springs the prominent rounded lobe of the valve, hinder valve a narrow ridge around the eductal section of the nostril. Eye medium, pupil elliptical, horizontal, orbit about one third of the preoral length of the snout. Mouth wide moderately arched, width three fourths of the distance from the end of the snout; labial folds half as long as the jaw on each side, hinder shorter. Teeth in $\frac{31}{25}$ rows, varied in shapes and sizes, Plate **4**, fig. 2–3; upper oblique, notched, or deeply excavated on the outer edge and denticulate on the basal portion (median 5 or 6 rows with less distinct denticles on the inner edge also), median two or three rows of smaller more erect teeth; lower teeth with erect narrow cusps on broad bases, without denticles. Anteriorly on the upper jaws there are several series of teeth in function, laterally there is but a single series; the small teeth of the symphyseal rows are about erect and each has one or more denticles on each edge. Spiracle larger than the pores, directly behind the eye and distant from it half the length of the orbit. Length of orbit more than greatest width of gill openings. Pectorals falciform, three fifths as wide as long, when applied to the side subtending six sevenths of the base of the dorsal, hinder margin concave, inner angle rounded. Dorsals alike in shape, hinder angle long pointed, upper blunted; space between dorsals less than length of caudal. Ventrals as large as the second dorsal, below the middle of the space between the dorsals. Anal half as large as the second dorsal, origin little farther back, end of base little behind the end of the base of that fin. Caudal moderate, length about one fourth of the total, pointed, a deep notch behind the subcaudal fin, subcaudal lobe sharp. Scales small, pedicellate, five-keeled, each keel ending in a point; inside of mouth and throat covered by sharp scales.

Greyish brown, olive in life; fins dark with light hinder margins; lower surfaces lighter.

Total length $25\frac{1}{2}$, snout to hindmost gill opening $5\frac{5}{8}$, snout to abdominal pores $12\frac{3}{4}$, caudal fin $5\frac{1}{2}$, snout to base of dorsal 7 inches.

Specimen received from the "Aquarial Gardens," the collections for which were made off the coasts of Massachusetts and Rhode Island.

Hemigaleus microstoma.

Hemigaleus microstoma Bleeker, 1852, Verh. Bat. gen. **24**, Plagios., p. 46, pl. 2, f. 9; Duméril, 1865, Elasm., p. 392; Günth., 1870, Cat., fishes Brit. mus., **8**, p. 375.

Head rather short, broader than high. Snout pointed, length greater than the width of the mouth. Nostrils little nearer to the end of the snout than to the angles of the mouth, midway in the preoral length, valves with an angular lobe. Mouth much wider than long; labial folds short, on both jaws, around the angle. Diameter of the eye three sevenths to three fifths of the preoral length of the snout. Upper teeth in 32 rows, triangular, oblique, outer margin serrated, inner margin convex, smooth; lower teeth smaller, broad-based, cusps narrow, slender, not serrated. Spiracle pore-like, behind the orbit. Width of gill openings greater than the diameter of the orbit. Pectorals nearly twice as long as broad, falciform, pointed, when applied to the side subtending half of the base of the dorsal. Dorsal near the middle of the space between pectorals and ventrals, about as high as long, with sharp angles. Second dorsal more than half the size of the first, origin slightly in advance of that of the anal. Anal smaller than second dorsal. Caudal pointed, about one fourth of the total length, equal to the distance between the dorsals.

Reddish grey, yellowish below, fins grey, apex of second dorsal white.

Java.

Hemigaleus macrostoma.

Hemigaleus macrostoma Bleeker, 1852, Verh. Bat. gen. **24**, Plagios., p. 46, pl. 2, f. 10; Duméril, 1865, Elasm., 392; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 376.
Chaenogaleus macrostoma Gill, 1861, Ann. N. Y. lyc., **7**, p. 411 (name only).

Head two thirteenths of the total length, broader than high. Snout pointed, length little greater than the width of the mouth. Nostrils nearer to the end of the snout than to the angles of the mouth, nearer to the mouth than to the end of the snout, with an angular lobe on the valves. Diameter of the eye two fifths of the width of the mouth. Mouth greatly arched, length little less than the width. Teeth in 34 rows, broad-based; upper oblique, concave on the edges, with two or three denticles on the outer edge of the base; median teeth small, erect; lower teeth triangular, acute, slender, smooth, erect. Labial folds con-

spicuous, upper little longer than the lower but less than a third of the width of the mouth. Spiracle small, larger than the pores, behind the orbit about half the diameter of the eye. Pectoral shorter than the head, less than twice as long as broad, falciform, blunted, extending below the middle of the dorsal. Dorsal little nearer to the pectoral than to the ventrals, as high as long, upper angle blunted. Origin of second dorsal little in advance of that of the anal, fin more than half the size of the first dorsal. Anal more than twice the length from the caudal pit, smaller than second dorsal. Caudal pointed, length three thirteenths of the total length, equal to the distance between the dorsals.

Back greyish, fins greyish or bluish grey, in part white-edged; below whitish.

Java.

Hemigaleus balfouri.

Hemigaleus balfouri Day, 1878, Ind. fishes, p. 717, pl. 185, f. 4.

Length of snout little more than the width of the mouth, little less than the distance from the eye to the first gill opening. Spiracle minute, a half diameter of the eye behind the orbit. Labial folds on both jaws, at the angle of the mouth. Gill openings at least twice the width of the orbit. Teeth in $\frac{24}{24}$ rows; upper notched or with about three denticles along the outer side of the base; lower slightly smaller, erect, smooth. Pectorals falciform, when applied to the side subtending the anterior third of the dorsal base. Base of the dorsal about midway between the base of the pectoral and that of the ventral. Second dorsal and anal nearly equal, bases opposed, that of the former slightly in advance of that of the latter and half as long as that of the first dorsal. Caudal one fifth of the total length, subcaudal lobe blunted. Length of the type $32\frac{1}{2}$ inches.

Dark brown, fins gray, upper part of second dorsal dark.

Coromandel Coast of India.

Eugaleus.

Galeorhinus Blainv., 1816, Bull. Soc. phil., p. 121 (part).
Galeus Cuv., 1817, Reg. anim., 2, p. 127 (not *Galeus* of Valmont, 1768, or of Raf., 1810).
Eugaleus Gill, 1864, Proc. Acad. nat. sci. Phil., p. 148 (name).

Body moderately slender, elongate, cavity about half of the total length. Head medium, from the snout to the hindmost gill opening about one fourth of the total, depressed and blunt forward. Mouth wide, with a short labial fold on each jaw. Teeth alike on both jaws, compressed, subtriangular, inclined toward the angles of the mouth, smooth on the edges, excepting two to four

denticles on the outer edge between the notch and the base. Orbit longer than wide, nictitating fold well developed. A small spiracle behind the eye. First dorsal above the space between pectorals and ventrals; second dorsal above the anal. Caudal rather short; subcaudal lobe, not very distant from the notch behind the subcaudal; caudal pits absent. Hindmost gill clefts above the pectorals. Species from Lower Tertiary closely resemble living forms.

Second dorsal and anal fins subequal

snout produced, anterior nasal valve with two points . *galeus* (page 153)

Second dorsal much larger than the anal

snout rather short, anterior nasal valve with a rounded lobe

japanicus (page 154)

Eugaleus galeus.

Galeus canis Rondelet, 1554, Pisc., p. 377; Müller & Henle, 1841, Plagios., p. 57; Bonaparte, 1841, Icon. Fauna Ital., Pesci; Gaimard, 1847, Isl. Poiss. pl. 21; Wright & Ekström, 1848, Skand. fisk., p. 185, pl. 45; Nilsson, 1855, Fisk. Skand., **4**, p. 714; Duméril, 1865, Elasm., p. 390; Bocage & Capello, 1866, Plagios., p. 18; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 379; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 36; Moreau, 1881, Poiss. France, **1**, p. 317.

Canis galeus Salviani, 1554, Aquat., f. 130, fig. 41, 132; Willoughby, 1686, Pisc., p. 51, pl. B6, f. 1.

Squalus sp. Artedi, 1738, Ichth., Syn., p. 97, Gen., p. 68, no. 9.

Squalus galeus Linné, 1758, Syst., **1**, p. 234; 1766, Syst., **1**, p. 399; Brünnich, 1768, Ichthy. Massiliensis, p. 4; Bonnaterre, 1788, Ichth., p. 7, pl. 6, f. 16; Gmelin, 1789, Linné Syst., **1**, p. 1492; Schn., 1807, Bloch Ichth., p. 128; Turton, 1807, Fauna, p. 112; Risso, 1810, Ichth. Nice, p. 32; Jenyns, 1835, Man., p. 501.

Tope Brookes, 1763, Nat. hist., **3**, Fishes, p. 31; Pennant, 1769, Zool., **3**, p. 87; 1776, Zool., **3**, p. 98.

Le milandre Broussonet, 1780, Mem. Acad. roy., p. 653; Duhamel, 1782, Traité, **4**, p. 299, pl. 20, f. 1, 2.

Galeorhinus galeus Blainv., 1816, Bull. Soc. philom., p. 121 (name only).

Carcharias galeus Risso, 1826, Hist. nat., **3**, Poissons, p. 121.

Galeus vulgaris Fleming, 1828, Brit. anim., p. 165; Yarrell, 1836, Brit. fishes, **2**, p. 390; Parnell, 1838, Mem. Wern. soc., **7**, p. 414; Kröyer, 1853, Danm. fiske, **3**, p. 834; Day, 1884, Brit. fishes, **2**, p. 292, pl. 153; Steindachner, 1900, Denk. Akad. wiss. Wien, **70**, p. 519.

Eugaleus galeus Gill, 1864, Proc. Acad. nat. sci. Phil., p. 148 (name only).

Toper Couch, 1867, Brit. fishes, **1**, p. 45, pl. 9.

Galeus linnéi Malm, 1877, Göteb. och Bohus. fauna, p. 618.

Galeorhinus zyopterus Jord. & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 871; Jord & Everm., 1896, Bull. 47, U. S. nat. mus., p. 32, pl. 4, f. 15.

Galeus chilensis Perez, 1886, Estudio p. 3; Philippi, 1887, Ann. Univ. Chile, **71**, p. 11, pl. 4, f. 2.

Galeorhinus chilensis Delfin, 1901, Cat. peces Chile, p. 17.

Galeus japonicus Jord. & Everm., 1905, Bull. U. S. fish comm., **23**, p. 36.

Galeus galeus Günth., 1910, Südsee fische, **3**, p. 482.

Head moderately broad and deep, depressed, narrowed forward; length of snout equal width of mouth, end blunt. Internarial space about half the preoral length, about twice the distance from the mouth to the nostrils, or half that between the angles of the mouth. Anterior narial valve with two points, an outer and an inner. Mouth wide, extending forward in an angle with rounded apex. Labial folds on each jaw, around the angles, not reaching halfway to the

symphysis, lower shorter. Teeth subtriangular, alike in the two jaws, oblique, inclined outward, in $\frac{35-37}{33-35}$ rows, smooth-edged except between the notch, on the outer edges, and the base where there are denticles; median smaller, notched on both sides. A couple of rows at each side of the median row are little larger. Eyes moderate, with a nictitating membrane, pupil vertical. Spiracle small, behind the middle of the eye. Pectorals larger than the dorsals, two thirds as wide as long, applied to the side subtending half or more of the dorsal. Origin of first dorsal behind the end of the pectoral base, fin much nearer to the pectorals than to the ventrals. Second dorsal small, origin little in advance of that of the anal. Anal little smaller than second dorsal, base extending slightly farther back. Ventral origins nearly in the middle of the total length. Caudal less than one fourth of the total length, distance from the produced lower lobe to the notch behind the subcaudal short.

Back brown, olive to ashy or rusty; lower surfaces, hind margins of pectorals and hind ends of dorsals white, end of tail and upper border of dorsal darker.

A specimen from the Mediterranean measures in total length $23\frac{1}{2}$, from snout to abdominal pores 12, to hindmost gill opening 5, to mouth $1\frac{3}{4}$ and in length of caudal fins $5\frac{1}{2}$ inches; one from San Diego, Cal., is in total length 25, from snout to pores $12\frac{1}{2}$, to hindmost gill opening 6, to mouth $2\frac{1}{8}$, and in length of caudal fins $6\frac{3}{8}$ inches. The slight differences in proportions appear to be quite within the range of individual variations.

Eugaleus japanicus.

Galeus japanicus Müller & Henle, 1841, Plagios., p. 58, pl. 22; Duméril, 1865, Elasm., p. 391; Günth., 1870, Cat., fishes Brit. mus., **8**, p. 380; Nyström, 1887, K. Svensk. vet. akad. handl., 50; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 611; Pietschmann, 1908, Sitzb. Akad. wiss. Wien, **117**, p. 51.

As compared with the preceding, *E. galeus*, the snout of this species is shorter, the anterior nasal valve is broader and more rounded, the mouth is shorter, the pectorals are longer and more pointed, the dorsal is farther back and about as near to the ventrals as to the pectorals, the second dorsal is larger and extends farther forward from the anal, the ventrals are farther in advance of the middle of the total length, the anal is much smaller in comparison with the second dorsal and is farther backward, the caudal is smaller, has a sharper subcaudal lobe and a longer distance from the lobe to the subcaudal notch. The teeth have two strong denticles between the notch on the outer edge and the base.

Japan.

CESTRACIONTIDAE.

The single genus in this family differs from Carcharinus in the peculiar lateral expansions of the skull across the frontal region, by which the eyes are carried much farther outward. As in that genus there are no spiracles, the nostrils are distinct from one another and from the mouth, the eyes have a well-developed nictitating membrane, the teeth are compressed and blade-like, the labial folds are rudimentary, and the first dorsal is in advance of the ventrals. The characters of the family are those of the genus Cestracion. Occurs in early Tertiary formations.

CESTRACION.

Cestracion KLEIN, 1742, Hist. pisc., miss. **3**, p. 12; 1776, Neuer schaupl., **3**, p. 523; WALBAUM, 1792, Artedi, p. 580.
Sphyrna RAFINESQUE, 1810, Indice, p. 60.
Cestrorhinus BLAINV., 1816, Bull. Soc. philom., p. 121.
Zygaena CUV., 1817, Reg. anim., **2**, p. 127.
Sphyrichthys THIENEMANN, 1828, Lehrb., **3**, p. 408.
Platysqualus SWAINS., 1839, Class., **2**, p. 318.
Sphyra HOEVEN, 1858, Handb., **2**, p. 68.
Reniceps GILL, 1861, Ann. N. Y. lyc., **7**, p. 403.
Eusphyra GILL, 1861, ibid.
Cestracion GILL, 1861, ibid.

Body, behind the head, similar to that of Scoliodon and its closer allies. Head much depressed, with a broad oculonarial expansion at each side. Mouth inferior, greatly arched forward. Teeth compressed, triangular, broad based, with cusps more or less obliquely directed toward the angles of the mouth and notched on the outer edges. Labial folds rudimentary. Eyes distant from the middle of the head; a nictitating membrane. No spiracles. First dorsal above the space between the pectorals and the ventrals. Second dorsal above the anal. Caudal with pits at its origin, and with a produced subcaudal lobe.

Head hammer-shaped, very wide
  eyes and nostrils widely separated
    oculonarial expansion wide, slender . . *blochii* (page 156)
  eyes and nostrils close together
    oculonarial expansion medium, oblique
      concavity above the nostril deep
        cusps of teeth prominent . . . *zygaena* (page 157)
      concavity above the nostril moderate
        cusps of teeth low, very oblique . . *oceanica* (page 158)

oculonarial expansion at right angles to body
a narial groove in front of the snout
outer edge of hammer rounded
front of snout broadly rounded . . *tudes* (page 159)
no narial groove
outer edges of hammer nearly straight
front of snout nearly straight . *mokarran* (page 160)
Head heart shaped
eyes and nostrils not widely separated
oculonarial expansion narrow . . . . *tiburo* (page 160)

Cestracion blochii.

Squalus zygaena Bloch, 1785, Ausl. fische, **1**, p. 29, pl. 117; Schneider, 1801, Bloch Ichth., p. 131.
Zygaena blochii Cuv., 1817, Reg. anim., **2**, p. 127; Valenciennes, 1822, Mem. Mus. hist. nat., **9**, p. 227, pl. 12, f. 2; Bennett, 1830, Mem. Raffles, p. 694; J. E. Cantor, 1837, Quart. med. journ. Calcutta, pl. 1–4; Trans. Med. & phys. soc., **8**, pt. 2, p. ccxi, App.; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 380.
Zygaena laticeps J. E. Cantor, 1837, Quart. med. journ. Calcutta, pl. 1–4; Swains., 1838, Class., **1**, p. 134, f. 11; 1839, **2**, p. 318; Yarrell, 1839, Brit. fishes, suppl., p. 64, f. 3, 4.
Sphyrna blochii Müller & Henle, 1841, Plagios., p. 54, 199; Bleeker, 1849, Verh. Bat. gen., **22**, p. 6; T. Cantor, 1849, Malay fishes, p. 1386; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 41, pl. 3, f. 7.
Eusphyra blochii Gill, 1861, Ann. N. Y. lyc., **7**, p. 412 (name).
Cestracion blochii Duméril, 1865, Elasm., p. 383.

Oculonarial expansions very slender, making the width of the head in small specimens little less than half the total length, nearly at right angles with the longitudinal axis, slightly oblique on the hind margin, broadly rounded on the outer edge, nearly straight between eye and nostril. Snout broadly rounded between the nostrils. Nostrils much nearer to the mouth than to the eyes, with a deep groove to the orbits and for a short distance toward the middle of the snout. Width of mouth nearly equal to the distance from the end of the snout; labial folds rudimentary. Teeth very oblique, deeply notched on the outer edge in $\frac{30}{29}$ rows; median teeth of upper jaw small, more erect, indented on both edges. Orbits separated by less than their width from the nostrils. Gill openings much wider than the orbits. Pectorals moderate, hind margin oblique, concave near the inner angle. Origin of the dorsal above the end of the pectoral base, length of base about half of the interdorsal space, or two thirds of the height of the fin, end not quite reaching a vertical from the ventrals. Second dorsal about half as large as the anal, origin above the middle of the anal base, ends of both base and fin extending a little farther back than those of the anal. Anal deeply

concave on the hind border, lower and hinder angles produced. Caudal about one third of the total length; subcaudal lobe produced.

Total length 16, snout to abdominal pores $7\frac{1}{4}$, snout to fifth gill opening $3\frac{1}{2}$, snout to mouth $1\frac{1}{8}$, width of head $7\frac{1}{2}$, snout to dorsal 4, and length of caudal $5\frac{3}{8}$ inches. Greatest length of the lateral expansion $1\frac{1}{2}$, and greatest width from the cheek 3 inches.

Specimen described from Penang.

East Indies and India.

CESTRACION ZYGAENA.

Plate **1**, fig. 1–3.

Libella BELON, 1553, Aquat., p. 61; SALVIANI, 1554, Aquat., f. 128, pl. 40.
Zygaena RONDELET, 1554, Pisc., p. 389; GESNER, 1558, Aquat., p. 1254; ALDROVANDI, 1613, Pisc. & cet., p. 408; JONST., 1649, Pisc., p. 29, pl. 7, f. 8; WILLUGHBY, 1686, Pisc., pl. B1.
Squalus sp. ARTEDI, 1738, Ichthyologia, Syn., p. 96, Gen., p. 67, no. 7; GRONOW, 1754, Mus., **1**, p. 63, no. 139; 1763, Zoophy., p. 32, no. 146.
Cestracion sp. KLEIN, 1742, Hist. pisc., miss. **3**, p. 13.
Squalus zygaena LINNÉ, 1758, Syst., **1**, p. 234; BRÜNNICH, 1768, Ichthy. Massiliensis, p. 4; RISSO, 1810 Ichth. Nice, p. 34; MITCH., 1815, N. Y. lit. & philos. trans., **1**, p. 482; Gray, 1854, Gron. syst., p. 6.
Balance fish BROOKES, 1763, Nat. hist., **3**, Fishes, p. 31.
Cestracion zygaena KLEIN, 1776, Neuer schaupl., **3**, p. 524, 706; GILL, 1862, Ann. N. Y. lyc., **7**, p. 403; DUMÉRIL, 1865, Elasm., p. 382; DAY, 1865, Fishes Malabar, p. 270.
Le marteau DUHAMEL, 1777, Traité, **3**, sect. 9, p. 303, pl. 21, f. 3–8; BROUSSONET, 1780, Mém. Acad. roy., p. 661.
Le squale marteau LACÉPÈDE, 1798, Poissons, **1**, p. 257.
Koma sorra RUSSELL, 1803, Coromandel fishes, **1**, p. 8, pl. 12.
Hammer-headed shark SHAW, 1804, Zool., **5**, pt. 2, p. 46; YARRELL, 1839, Brit. fishes, suppl., p. 61.
Sphyrna zygaena RAFINESQUE, 1810, Ind. itt. Sic., p. 46; MÜLLER & HENLE, 1841, Plagios, p. 51; BONAPARTE, 1841, Icon., Fauna Ital., Pesci, Tav. 50, fig. 1; T. CANTOR, 1849, Malay fishes, p. 1383; BLEEKER, 1852, Verh. Bat. gen. **24**, Plagios., p. 42, pl. 3, f. 8; BOCAGE & CAPELLO, 1866, Plagios., p. 17; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 45.
Zygaena zygaena CUV., 1817, Reg. anim., **2**, p. 127; GÜNTHER, 1810, Südsee fische, **3**, p. 434.
Zygaena malleus VALENCIENNES, 1822, Mem. Mus. hist. nat., **9**, p. 223, pl. 11, f. 1; RISSO, 1826, Hist. nat., **3**, Poissons, p. 125; JENYNS, 1835, Man., p. 507; DE KAY, 1842, N. Y. fish., p. 362, pl. 62, f. 204; SCHLEGEL, 1850, Jap. Pisces, p. 306, pl. 138; STORER, 1867, Mass. fish., p. 262, pl. 38, f. 3; GÜNTH., 1870, Cat. fishes Brit. mus., **8**, p. 381; DAY, 1878, Ind. fishes, p. 719, pl. 186, f. 4; DODERLEIN, 1881, Man. ittiol. Medit., **2**, p. 46; MOREAU, 1881, Poiss. France, **1**, p. 324; DAY, 1884, Brit. fishes, **2**, p. 294, pl. 154.
Sphyrichthys zygaena THIENEMANN, 1828, Lehrb., **3**, p. 408.
Sphyrnias zygaena GRAY, 1851, Chondropterygii, p. 49.
Sphyra malleus HOEVEN, 1858, Handb., **2**, p. 68.
Hammer-head COUCH, 1867, Brit. fishes, **1**, p. 70, pl. 16.

Front margin of the head a broad irregular curve which may be included in the segment of a circle with a radius from the fifth gill openings, but not continuous with the lateral edges of the hammer. Width of hammer, oculonarial expansion, on the hind margin nearly equal to its length across the end at the eye. A rather deep concave notch above the nostril, which latter has a groove on the front margin, more than half the distance to the middle of the snout. Orbit

rather large, width less than half the distance from the nostril. Mouth large, width about equal to the distance from the end of the snout, length little more than half the width; labial folds rudimentary or absent. Teeth similar in the two jaws, oblique with a nearly straight inner margin, and a deeply notched outer, and with very fine serrations in young. Dorsal origin behind the end of the pectoral base, height of fin much greater than length of base; base equal little more than one third of the space between the dorsals, or one fourth of the distance from the snout. Base of second dorsal half as long as that of the anal, origin above the middle of the anal base, end of fin little farther back than in the anal. Caudal nearly one third of the total length; subcaudal lobe much produced.

Total length $24\frac{1}{2}$, snout to abdominal pores 12, snout to fifth gill opening $5\frac{3}{8}$, snout to mouth $1\frac{1}{2}$, snout to dorsal $6\frac{7}{8}$, length of caudal $7\frac{3}{8}$ inches.

Specimen described from New York, Prof. L. Agassiz.

Ashy brown; lighter to white below.

Tropical and temperate Seas.

Cestracion oceanica, sp. nov.

Closely allied to *C. zygaena*, similar in most respects, but distinguished by the following: — body more robust, tail longer, dorsal farther forward, second dorsal ending more directly above the end of the anal, separation between eye and nostril wider, groove from the inner edge of the nostril shorter, concavity above the nostril shallower, mouth smaller, teeth smaller and more oblique, and orbitonarial extension less slender. The origin of the dorsal is above the end of the pectoral base. The teeth are small, the cutting edge of the cusp is so oblique as to be nearly parallel with the base, making the notch on the outer edge very sharp, and giving the sharp angle of the cusp little prominence. In young of *C. zygaena*, three fourths as long as the types of *C. oceanica*, the teeth are larger and much more erect. Near the middle of the mouth the cusp in the types is slightly more prominent than farther toward the angles of the mouth along the sides. In the young *C. zygaena* the notch in the tooth is more nearly a right angle. The length of the oculonarial expansion behind the nostril is greater than its width opposite the mouth along the hind margin. Compared with *C. tudes* the hammer is much more oblique, the front margin of the head is much less straight, and the teeth are smaller, more equal and less erect.

The specimens are grey or ash-colored, yellowish or white beneath, and have

a blackish spot on the upper angle of the second dorsal, on the lower angle of the subcaudal lobe and on the tip of the tail.

Society Islands, collected by Andrew Garrett.

Cestracion tudes.

Cornuda Parra, 1787, Hist. nat., p. 71, pl. 32.
Zygaena tudes Valenciennes, 1822, Mém. Mus. hist. nat., **9**, p. 225, pl. 12, f. 1; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 382; Moreau, 1881, Poiss. France, **1**, p. 327; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 50.
Sphyrna tudes Müller & Henle, 1841, Plagios., p. 53.
Sphyrnias tudes Gray, 1851, Chondropterygii, p. 53.
Cestracion (*Zygaena*) *tudes* Duméril, 1865, Elasm., p. 384.
Sphyrna (*Platysqualus*) *tudes* Jord & Everm., 1896, Bull. 47, U. S. nat. Mus., p. 44.

Head and hammer more exactly transverse than in *C. zygaena;* hind margins of the hammer at right angles to the longitudinal axis; front margin much curved, undulated, with a shallow concave indentation above the nostril, front outline forming a segment of a circle the centre of which is about opposite the fifth gill openings, the curve continuing in sharper curves around the lateral edges of the hammer and the hinder angles to the nearly straight hinder edges. Width of oculonarial expansion, near the mouth, about equal to its length behind the nostril across the end. Nostrils with a groove toward the middle of the snout; in cases, perhaps fresher specimens, the groove is filled and hardly visible. Eye small, one diameter of the orbit from the nostril. Mouth large, length half the width, or three sevenths of the length of the snout. Teeth unlike, in $\frac{30}{29}$ rows; bases broad somewhat swollen, two-rooted; cusps narrower, upper oblique with a sharp notch on the outer edge; lower cusps narrower, more slender, more erect, especially toward the middle of the mouth where the teeth resemble those of species of Isurus; median teeth of the upper jaw and the median tooth of the lower quite small. Dorsal origin slightly behind the base of the pectoral; fin large, triangular, height little greater than the length, upper angle sharp, hind margin not greatly concave; base two and one fifth times in the distance from the second dorsal; end of the fin reaching a vertical from the ventrals. Ventrals in front of the mid length. Second dorsal small, base above the hind half of that of the anal, upper angle rounded. Anal elongate, lower angle produced, hind margin concave, base one and one half times in its distance from the caudal. Caudal two sevenths of the total, subcaudal lobe strong, produced, slightly blunted.

Total length 35, snout to abdominal pores 16, snout to fifth gill opening $7\frac{3}{4}$, snout to first dorsal $10\frac{1}{4}$, snout to mouth $2\frac{7}{8}$, greatest width of head $8\frac{7}{8}$, and length of caudal 10 inches.

Greyish brown, head darker, fins darker with light margins. Described from specimens taken at Rio Janeiro and Panama.

Tropical Seas.

Cestracion mokarran.

Zygaena mokarran Rüppell, 1835, Neue wirb. Abyssinien, fische, p. 66, pl. 17, f. 3; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 383; Day, 1887, Ann. mag. nat. hist., ser. 5, **20**, p. 389; 1888, Ind. fishes, suppl., p. 809.
Sphyrna mokarran Müller & Henle, 1841, Plagios, p. 54.
Sphyrnias mokarran Gray, 1851, Chondropterygii, p. 51.
Cestracion (Zygaena) mokarran Duméril, 1865, Elasm., p. 383.
Zygaena dissimilis Murray, 1887, Ann. & mag. nat. hist., ser. 5, **20**, p. 304.

Width of head one fourth less than the length of the caudal. Oculonarial expansions at the sides of the head nearly at right angles with the longitudinal axis of the body; anterior margin of the head nearly straight. Nostrils near the eye, without a notch above them, without a groove from their inner edges. Teeth triangular, oblique, with fine serrations on the edges; upper broader, notched on the outer edge; lower with the cusp more erect and slender, with an indentation on both outer and inner edges. Hindmost two of the gill openings above the pectoral. All fin angles rather sharp; first dorsal higher than long, origin above the end of the pectoral base, at about one fourth of the length from the snout to the end of the tail, base equal half the height on the front margin. Ventrals in front of the mid length. Second dorsal and anal nearly equal, similar in shapes; anal origin slightly behind that of the dorsal; hind margins deeply indented. Reaching a length of more than ten feet.

Dingy bluish gray or brown, lighter to whitish or flesh color below.

Red Sea; India.

Cestracion tiburo.

Plate **1**, fig. 4–5.

Tiburonis species minor Marcgrave, 1648, Hist. nat. Brasil., p. 181, fig.
Zygaenae affinis capite triangulo Willughby, 1686, Hist. pisc., p. 55, pl. B9, f. 3.
Cestracion no. 2 Klein, 1742, Hist. pisc., miss., **3**, p. 13, pl. 2, f. 3, 4.
Squalus tiburo Linné, 1758, Syst., **1**, p. 234; 1766, Syst., **1**, p. 399; Bonnaterre, 1788, Ichth., p. 9; Gmelin, 1789, Linné Syst., **1**, p. 1495; Shaw, 1795, Nat. misc., **7**, pl. 229; Schn., 1801, Bloch Ichth., p. 131.
Cestracion tiburo Klein, 1776, Neuer schaupl., **3**, p. 526; Gill, 1861, Proc. Acad. nat. sci. Phil., p. 59 extra; Duméril, 1865, Elasm., p. 385.
Le pantouflier Broussonet, 1780, Mém. Acad. roy., p. 662.
Round-headed Zygaena Shaw, 1795, Nat. misc., **7**, pl. 229.
Heart-headed shark Shaw, 1804, Zool., **5**, p. 355, pl. 154.
Sphyrna tiburo Rafinesque, 1810, Ind. Sic., p. 47; Müller & Henle, 1841, Plagios., p. 53; Gilbert & Starks, 1903, Mem. Cal. acad. sci., **4**, p. 13.
Cestrorhinus tiburo Blainv., 1816, Bull. Soc. philom., p. 121.

Zygaena tiburo Valenciennes, 1822, Mem. Mus. hist. nat., **9**, p. 226, pl. 12, f. 2^a, 2^b; Yarrell, 1839, Brit. fishes, suppl., p. 64, f. 2; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 382; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 50.

Platysqualus tiburo Swains., 1839, Class., **2**, p. 318.

Sphyrnias tiburo Gray, 1851, Chondropterygii, p. 50.

Reniceps tiburo Gill, 1861, Ann. N. Y. lyc., **7**, p. 412; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 25.

Sphyrna (Reniceps) tiburo Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 44; 1900, ibid., Atlas, pl. 5, f. 19.

Front and sides of the head in continuous curves; front margin in the segment of a circle having its centre a short distance behind the symphysis of the lower jaws. No indentation above the nostrils. Grooves from the inner edges of the nostrils rudimentary. Nostrils separated from the eyes by one length of the orbit. Hind margin of the oculonarial expansion short, about one fourth as wide as the head. Mouth large, width about one third of that of the head, or four fifths of the distance from the end of the snout, length nearly half of the width. Teeth in $\frac{26}{25}$ rows, broad-based, oblique, notched on the outer border, or indented on both edges in some; upper teeth with inner margins less concave and with cusps less erect than the lower; median teeth small, more indented on both edges; cusps smaller to obsolete toward the angles of the mouth. Pectorals broad, angles rounded. Origin of dorsal little behind the ends of the bases of pectorals, length of base two thirds of the height, upper angle blunted, end reaching a vertical from the ventrals. Origin of second dorsal little forward of the middle of the anal base, end slightly in front of that of the anal, outer angle more produced and hind margin more concave than in that fin. Base of anal longer than its distance from the caudal. Caudal less than one third of the total, lower lobe produced.

Total length $22\frac{1}{2}$, snout to abdominal pores 11, snout to fifth gill opening 5, snout to mouth 2, greatest width of head $4\frac{5}{8}$, snout to dorsal 7, and length of caudal $6\frac{3}{4}$ inches.

Ashy brown, shading to white on the lower surfaces; fins darker with light margins. Specimen described is from Massachusetts Bay.

Tropical and temperate seas.

Galeorhinidae.

Body elongate; head and snout depressed; tail compressed. Eyes lateral, with a nictitating fold in the lower lid. Nostrils below the snout. Mouth inferior, crescentic. Teeth small, in numerous rows, several series in function, cuspidate to flat, in bands or in pavement. Spiracles present or absent. Two dorsal fins, without a spine, first above the space between pectorals and ventrals. An anal.

Teeth compressed, cusps three to five, a number of series in function
  spiracles absent; a nictitating fold
    teeth with shorter lateral cusps
      subcaudal lobe produced; a caudal pit . *Triaenodon* (page 162)
      subcaudal lobe rudimentary; no caudal pit *Leptocharias* (page 164)
  spiracles present; a nictitating fold; no caudal pit
    teeth three cusped; labial folds long . . . *Triakis* (page 165)
Teeth in pavement; labial folds long; subcaudal lobe not produced
  spiracles present; a nictitating fold; no caudal pits
    teeth blunt or with rudimentary cusps . . *Galeorhinus* (page 169)
    teeth with flattened crowns; nasoral grooves *Scylliogaleus* (page 179)

Triaenodon.

Triaenodon Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 113; 1837, Wiegm. arch., p. 396; 1841, Plagios., p. 55.

Trunk shaped like that of Galeus; head depressed; snout short, broad. Crown broad, convex. Mouth greatly arched; labial folds rudimentary. Eyes lateral, with a nictitating membrane. No spiracles. Teeth equal, small, numerous, with a stronger median cusp and one or two small lateral cusps at each side of it. Hindmost gill clefts above the pectorals. First dorsal above the space behind the pectorals; second dorsal above the anal. Caudal with a pit at its root above; subcaudal lobe well developed. Scales small, 3–7 keeled.

Dorsal origin at a distance from the pectorals
  second dorsal little larger and little forward of anal . *obesus* (page 163)
Dorsal origin close behind bases of pectorals
  second dorsal and anal subequal . . . . *obtusus* (page 163)

Triaenodon obesus.

Carcharias obesus Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 64, pl. 18, f. 2.
Triaenodon obesus Müller & Henle, 1841, Plagios., p. 55, pl. 20; Duméril, 1865, Elasm., p. 386; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 383; Klunzinger, 1871, Syn. fische, **2**, p. 227; Günther, 1910, Südsee fische, **3**, p. 482.
Leptocharias obesus Gray, 1851, Chondropterygii, p. 51.

Head broader than deep, narrowing forward; snout short, broad, broadly rounded in front, not as long as the mouth. Nostrils nearer to the mouth than to the end of the snout; anterior valves folded inward so as to appear double, with a short rounded lobe. Mouth wide, greatly arched, labial folds short, hardly extended along the jaws. Teeth small, numerous, with a stronger more or less oblique median cusp and at each side of the base of this one to two smaller ones, in 45–47 rows. Eye small, nictitating membrane well developed. No spiracle. Gill openings narrow, greatest width equal to length of orbit, hindmost above the base of the pectoral. Hind margins of fins indented; hinder angles of dorsals and anal produced. Pectorals longer than wide, outer angle rather sharp. First dorsal twice as large as the second, at a distance behind the pectorals and reaching to a vertical from the ventrals. Second dorsal little larger than the anal, origin little if any farther forward and base and tip extending little farther backward than those of that fin. Caudal little more than one fourth of the total length, with a pit at the root above, and with a sharply produced subcaudal lobe, subcaudal narrow between the notch and the lobe.

Rusty or ashy brown, lighter beneath, edges of fins darker except tips of dorsals and caudals, which are white.

Red Sea; Indian Ocean.

Triaenodon obtusus.

Triaenodon obtusus Day, 1878, Ind. fishes, p. 720, pl. 189, f. 3.

Snout short, length hardly equal to half the width of the mouth. Nostrils nearer to the end of the snout than to the mouth; anterior valve with a short pointed lobe. Width of the mouth more than twice the length; labial folds short, at the angles. Teeth with a small median cusp and a single smaller lateral denticle at each side of its base. Dorsal origin close behind the bases of the pectorals, fin not reaching to the ventrals. Applied to the side the pectoral subtends half or more of the dorsal; fin longer than wide, outer angle produced, blunted. Second dorsal and anal subequal, the former above the latter and very little in ad-

vance, hind margin of anal more deeply indented. Caudal nearly one fourth of the total length; subcaudal lobe well developed, its angle rounded off.

Dark above; lighter below.

Kurrachee, India.

Leptocharias.

Leptocharias Müller & Henle, 1838, Charlesworth's mag., **2**, p. 36.
Leptocarcharias Günth., 1870, Cat. fishes Brit. mus., **8**, p. 384.

Trunk rather slender; head short; snout produced, rounded at the end. Anterior nasal valve with an elongate lobe. A nictitating membrane. No spiracles. Mouth greatly arched; labial folds well developed. Teeth equal, small, numerous, with a longer median cusp and one to three smaller lateral cusps at each side of it on the base. First dorsal above the space between pectorals and ventrals; second dorsal above the anal. Hindmost gill openings above the bases of the pectorals. Caudal without a pit at its root; subcaudal lobe small, undeveloped.

Leptocharias smithii.

Triaenodon smithii Müller & Henle, 1841, Plagios., p. 56, p. 21; Duméril, 1865, Elasm., p. 387.
Leptocharias smithii Gray, 1851, Chondropterygii, p. 51.
Leptocharcharias smithii Günth., 1870, Cat. fishes Brit. mus., **8**, p. 384.

Body elongate; head nearly one fifth of the entire length; length of the snout hardly equal to the width of the mouth. Nostrils nearer to the mouth than to the end of the snout, anterior valve with a long pointed lobe. Mouth large, length about two thirds of the width; labial folds elongate. Teeth small, numerous, alike in the two jaws, with a longer more or less oblique median cusp which has at each side of its base one to two smaller ones; cusps decreasing in size toward the angles of the mouth; median tooth of the lower jaws small, erect. Pectorals triangular, outer angle produced, blunted. First dorsal midway between pectorals and ventrals, upper angle blunt, hinder sharp, hind margin concave. Second dorsal little smaller than the first, above the anal with nearly half of its base extending farther forward. Anal much smaller than the second dorsal, base extending somewhat farther back. Ventrals little in advance of the middle of the total length. Caudal rather short, subcaudal lobe not prominent.

Reddish brown, lighter below.

Cabenda Bay, South Africa.

Triakis.

Triakis Müller & Henle, 1838, Charlesworth's mag., **2**, p. 36; 1841, Plagios., p. 63.

Head depressed, flattened beneath, snout blunt. Anterior nasal valve with a rounded lobe. Eye with a nictitating fold. Spiracles small, behind the eyes. Mouth arched, labial folds and labial cartilages well developed. Teeth small, numerous, bases two-rooted, each tooth with a stronger median cusp and at each side of its base a denticle or denticles. Hindmost gill clefts above the pectorals. First dorsal above the space between the pectorals and the ventrals. Second dorsal above the anal. Caudal short, no pit at its origin, a notch behind the subcaudal; subcaudal lobe small.

Median cusp of teeth acuminate, lateral cusps sharp

greyish with cross bands and large alternating spots of brown *semifasciata* (page 165)

brown with cross bands of darker and with scattered spots of black *scyllium* (page 166)

Median cusp of teeth short, broad-based, lateral cusps short

slaty brown with scattered small spots of black . *maculata* (page 167)

greyish brown, uniform . . . . . *henlei* (page 168)

Triakis semifasciata.

Plate **50**, fig. 5, 11, 12.

Triakis californica Gray, 1851, Chondropterygii, p. 56 (name only).

Triakis semifasciatum Girard, 1854, Proc. Acad. nat. sci. Phil., p. 196; 1858, Rept. Pacif. R. R. Fish, p. 362; Duméril, 1865, Elasm., p. 398; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 384; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 20; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 31.

Trunk elongate, compressed; head rather narrow, depressed, flattened beneath, crown little convex; snout rounded in front and on the edges. Nostrils nearer to the mouth than to the end of the snout; anterior valve with a somewhat produced rounded lobe above which there is an internal bilobed fold, the partition. Eyes small, with a nictitating fold, Plate **50**, f. 5. Spiracles small, distant behind the eye less than half the length of the orbit. Mouth in a low arch; labial folds extending about half the length of the jaw, above and below. Teeth very small, numerous; median cusp strong, oblique, with one or more smaller ones, denticles, at each side of its base. Largest gill opening about the length of the orbit, hindmost small, above the pectorals. Pectorals short, subtriangular, two thirds as wide as long, angles rounded, hind margin nearly straight,

fin applied to the side reaching below the middle of the dorsal. Dorsal moderate, origin little forward of the hind margin of the pectoral, upper angles rounded, produced extremity reaching a vertical from the ventrals. Vent near the middle of the total length, second dorsal more than half as large as the first, similar in shape, equal in base. Anal less than half as large as the second dorsal, origin below the middle of the base of the second dorsal, base reaching behind that of the dorsal about one length of the orbit. Caudal less than one fourth of the total length; subcaudal fin followed by a notch, lobe very small.

Light brownish or greyish, lighter yellowish or whitish below; back with about a dozen transverse bands of brown each about as wide as the internarial space, separated by spaces of equal or greater width, below which are large alternating spots of brown. In cases there are narrow streaks of brown bisecting the spaces, and, on the lower parts of the sides of the body, some smaller spots. There is a large spot above the base of the pectoral and there are small ones scattered over the head and the caudal fins. The color is most often lighter in the centres of spots and bands.

California to Mexico.

Triakis scyllium.

Triakis scyllium Müller & Henle, 1841, Plagios., p. 63, pl. 26; Duméril, 1865, Elasm., p. 397; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 384; Ishikawa & Matsuura, 1897, Cat. fishes, p. 62; Jord. & Snyder, 1900, Proc. U. S. nat. mus., **23**, p. 336; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 609; Pietschmann, 1908, Sitzb. Akad. wiss. Wien, **117**, p. 689.

Trunk elongate, subtriangular in cross section, with a low ridge above the vertebrae. Head depressed, flat beneath, broader than high, crown little convex. Snout short, rounded, blunt, length nearly equal to width of mouth. Nostrils nearer to the mouth than to the end of the snout; anterior valve wide, broadly rounded, with an internal fold and pointed lobe above it. Mouth in a low arch, nearly three times as wide as long; labial folds wide and thick, almost half the length of each jaw, lower shorter. Teeth small, numerous, closely set, oblique, each with a denticle or two denticles at each side of the long acuminate median cusp. Length of orbit greater than the width of the hindmost gill opening, less than half the preoral length of the snout. Spiracle small, behind the eye a half length of the orbit. Pectoral large, width more than two thirds of the length, inner angle rounded, outer blunted, fin applied to the side subtending half the base of the dorsal. Dorsal origin above the hind margin of the pectoral, length of base more than half its distance from the second dorsal, hinder angle reaching a vertical from the ventrals. Second dorsal little smaller than the first, origin

in front of that of the anal. Anal much smaller than the second dorsal, origin below the middle of the base of the latter, end extended behind that of the same fin about the length of the orbit, hind margin more deeply excavated. Caudal one fourth of the total, subcaudal lobe slightly produced.

Olive brown, with a few spots of black, the largest about the size of the eye, scattered over the sides; with eight or ten rather indefinite bands of darker across the back and the flanks: first band across the nape, second to the middle of the pectorals, third at the origin, fourth near the middle and fifth at the end of the dorsal, sixth in the middle of the space between the dorsals, seventh at the origin, and eighth at the end of the second dorsal. Scales small, tricarinate.

Total length $28\frac{3}{4}$, snout to abdominal pores $13\frac{1}{2}$, snout to hindmost gill opening $5\frac{1}{2}$, and caudal 7 inches.

Japan. Alan Owston.

Triakis maculata.

Triakis maculatus Kner & Steindachner, 1867, Sitzb. Akad. wiss. Wien, **54**, p. 391.
Mustelus maculatus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 387.

Head broader than high, depressed, flattened beneath, convex on the crown, length less than one fourth of the total length. Nostrils nearer to the mouth than to the end of the snout, internarial space equal to the length of the mouth or to half the width; anterior valve with a rather broadly rounded lobe. Mouth moderate, broadly arched; labial folds wide, reaching nearly half the length of each jaw. Teeth small, numerous, arranged as in the species *Galeorhinus mustelus*, and *T. henlei*, but with cusps sharper than those of the former, the median cusp being short and broad at its base and obliquely directed outward and the lateral denticles mere rudiments separated from the median by shallow notches of which the inner is sometimes absent. Eye small; nictitating fold well developed but indistinct at the backward end. Spiracle small, distant from the orbit half the length of the eye. Gill openings small, greatest width about equal the length of the orbit, hindmost above the bases of the pectorals. Pectorals large, nearly as broad as long, with angles rounded, hind border slightly concave, fin applied to the side subtending half the base of the dorsal. Hinder angle produced on dorsals, ventrals, and anal. Origin of the dorsal above the hind margins of the pectorals, end of the fin reaching to a vertical from the origins of the ventrals, which are little forward of the middle of the total length. Second dorsal little smaller than the first, similar in shape, origin little behind the ends of the ventrals. Anal much smaller than the second dorsal and originating below the

middle of its base, the base of the anal extending but little the farther back. Tail short, less than one fourth of the total length; caudal small, narrow, no pit at its root, tip bluntly rounded, subcaudal followed by a notch, lobe feebly developed.

Slaty brown, with numerous irregular scattered spots of black on back and flanks.

Total length 22, snout to abdominal pores $10\frac{3}{4}$, snout to fifth gill opening $4\frac{5}{8}$, snout to mouth $1\frac{1}{4}$, and caudal 5 inches.

Description from specimens taken at Callao, Peru, by the Hassler Expedition.

Triakis henlei.

Plate **5**, fig. 1–4; Plate **50**, fig. 1–4.

Rhinotriacis henlei Gill, 1862, Proc. Acad. nat. sci. Phil., p. 486; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 31.
Triakis henlei Putnam, 1863, Bull. M. C. Z., **1**, p. 14; Duméril, 1865, Elasm., p. 398; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 20.
Pleuracromylon laevis Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, p. 52.

Trunk elongate, subtriangular in a cross section, with a low fold above the vertebrae. Head long, depressed, flat beneath, broader than high, little convex on the crown. Snout pointed, blunted at the end, length greater than the width of the mouth. Nostrils in the hindmost third of the preoral length; anterior valve short, rounded, with two internal lobes on the fold dividing the nostril above it. Mouth nearly straight at the sides, rounded in front; labial folds on both jaws well developed. Orbit elongate, length greater than the width of the gill openings; nictitating fold well differentiated. Spiracle small, close behind the eye. Hindmost gill opening narrow, above the pectoral. Teeth small, numerous, compressed, subtriangular, oblique, broad-based; cusps short, sharp, broadening in the base, on each side of which there is usually a notch with a denticle. On the inner edge of some teeth both notch and denticle may be absent. Pectorals short and broad, width three fourths of the length, angles rounded, hind margin nearly straight, fin applied to the side reaching behind the middle of the entire dorsal. Dorsal origin little behind the ends of the bases of the pectorals, length of base, much greater than the height, equal to two fifths of the distance from the second dorsal. Second dorsal more than half as large as the first, of similar form, distant more than the length of the base from the caudal. Anal small, hardly half as large as the second dorsal, origin nearly below the middle of the base and end little farther back than that of the same fin. Caudal one fifth of the total length, subcaudal lobe slightly developed.

Back uniform greyish brown; lower surfaces whitish.

Total length 26, snout to abdominal pores 12, snout to hindmost gill opening 5, snout to mouth $1\frac{7}{8}$, and caudal $5\frac{1}{8}$ inches.

Specimens described from San Francisco, Cal., collected by Alexander Agassiz and Thomas G. Cary.

Galeorhinus.

Mustelus Valmont, 1768; Linck, 1790; Cuvier, 1817.
Galeorhinus Blainv., 1816, Bull. Soc. philom., p. 121, 1830, Poiss. Fr., p. 81 (part).
Pleuracromylon Gill, 1864, Proc. Acad. nat. sci. Phil., p. 148 (name).
Cynias Gill, 1903, Proc. U. S. nat. mus., **26**, p. 960 (name).

Body and tail nearly equal in length. Head short, broad, depressed, tapering anteriorly, broader and flattened below. Snout produced, rounded on the end. Eyes lateral, lower lid with a nictitating fold. Nostrils large, far apart, without a nasoral groove; anterior valve produced in its outer angle. Spiracles small, behind the eye. Mouth subangular, rounded anteriorly; labial fold well developed. Teeth small, numerous, in pavement, smooth or with shallow notches or low cusps. Dorsals similar in shape, first above the abdomen, second above the anal. Tail without pits; caudal fins not deep; subcaudal followed by a notch, lobe feebly developed.

G. stefanii Lawley is from the Pliocene of Tuscany.

When all of the species of this genus are better known it may be that they can be arranged according to the presence or absence of a placental attachment for the young. At present it is known that in *G. stellatus*, and *G. manazo* this attachment is absent, that it obtains in *G. laevis*, *G. californicus*, and *G. dorsalis*, and that in *G. antarcticus* the young are developed in compartments, formed around each of them in the oviducts, according to Parker, 1882, 1890, or on a placental attachment according to Waite, 1909. Apparently the species with the smoother teeth are those without the placenta, while, on the other hand, those with teeth approaching the cuspidate forms in species of Triakis are those that possess it. See Plate 60, f. 1–4 and explanation.

Commonly spotted with white
dorsal origin near the axil of the pectoral
teeth without notches
upper labial fold longer . . . *mustelus* (page 170)
dorsal origin above the inner angle of the pectoral
teeth with a shallow undulation on the hinder edge
upper labial fold longer . . . . *manazo* (page 171)

Commonly with transverse bands
dorsal origin little behind axil of pectoral
teeth smooth, no denticles
upper labial fold shorter . . . . *fasciatus* (page 172)
Commonly spotted with black
dorsal origin behind inner angle of pectoral
teeth slightly angled, upper, without denticles
upper labial fold equal . . . *punctulatus* (page 173)
Commonly about uniform
dorsal origin forward of inner angle of pectoral
teeth with a low apex and a concavity at each side of it
upper labial fold shorter . . . . *lunulatus* (page 174)
dorsal origin above the inner angle of the pectoral
teeth without a produced cusp, slightly concave on inner edge
upper labial fold longer . . . *antarcticus* (page 175)
dorsal origin forward of the inner angle of the pectoral
teeth with notches or denticles
upper labial fold equal . . . . . *laevis* (page 176)
dorsal origin above the inner angle of the pectoral
teeth with a shallow concavity on the outward edge
upper labial fold equal . . . . *californicus* (page 177)
dorsal origin above middle of inner margin of pectoral
teeth diverse, upper oblique triangular, notched on outward edge
upper labial fold little longer . . . . *dorsalis* (page 178)

Galeorhinus mustelus.

Galeus asterias Rondelet, 1554, Pisc., p. 376; Aldrovandi, 1613, Pisc. & Cet., p. 393.
Mustelus laevis Salviani, 1554, Aquat., pl. 44.
Galeus laevis Gesner, 1558, Aquat., p. 726.
Squalus mustelus Linné, 1758, Syst., **1**, p. 235 (part); 1766, Syst., **1**, p. 400; Gmelin, 1789, Linné Syst., **1**, p. 1492.
Smooth dog-fish Brookes, 1763, Nat. hist., **3**, Fishes, p. 33.
Galeus stellatus Valmont, 1768, Dict. hist. nat., **4**, p. 746; Duhamel, 1777, Traité, **3**, sect. 9, p. 300.
Smooth hound Pennant, 1769, Zool., **3**, p. 91; 1776, Zool., **3**, p. 102, pl. 16; Yarrell, 1836, Brit. fishes, **1**, p. 393; Thompson, 1839, Ann. nat. hist., **2**, p. 272; Couch, 1867, Brit. fishes, **1**, p. 47, pl. 10.
Le squale emissole Lacépède, 1798, Poissons, **1**, p. 242; Blainv., 1830, Poiss. Fr., pl. 20, f. 2, pl. 20, f. 1, lentillat.
Galeus mustelus Rafinesque, 1810, Ind. itt. Sic., p. 46 (name); Leach, 1814, Mem. Wern. soc., **2**, p. 63, pl. 2, f. 3.
Squalus (Galeorhinus) mustelus Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 81.
Mustelus stellatus Risso, 1826, Hist. nat. **3**, Poissons, p. 126.
Squalus (Galeorhinus) hinnulus Blainv., 1830, Poiss. Fr., p. 83.
Squalus (Mustelus) stellatus Voigt, 1832, Thierreich., **2**, p. 508.

Mustelus plebejus Bonaparte, 1841, Icon. Fauna Ital., Pesci, p. 49; Canestrini, 1872, Ital. pesci, p. 49; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 30.

Mustelus vulgaris Müller, 1842, Abh. Akad. wiss. Berlin, p. 187, pl. 3, f. 2; Müller & Henle, 1841, Plagios., p. 64, 190, pl. 27, f. 1 (part); Duméril, 1865, Elasm., p. 400, pl. 3, f. 1–3; Günth., 1870 Cat. fishes Brit. mus., **8**, p. 386; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 30; Moreau, 1881, Poiss. France, **1**, p. 311.

Mustelus mustelus Pietschmann, 1908, Sitzb. Akad. wiss. Wien, **117**, p. 690.

Head broader than high, flattened below; snout broadly rounded forward. Nostrils large, much nearer to the mouth than to the end of the snout; anterior valve broad, with a somewhat produced and rounded lobe. Mouth large, width little less than length of snout, length less than length of orbit; labial folds nearly half the length of the jaws, upper fold longer. Teeth small, smooth, convex on the crown, without notches on the edges, without a sharp cusp or denticle. Eye rather large, pupil horizontally elongate, orbit nearly twice the preoral length. Spiracles small, distant from the eye about one fourth of the length of the orbit. Gill openings wide, greatest width one fourth less than length of orbit. Pectorals large, width about two thirds of the length, outer angle pointed, inner rounded, hind margin little concave. Dorsal large, origin a short distance behind the end of the pectoral base, much in advance of the hind margin of the pectoral, length of base greater than height, equal half the distance from the second dorsal; produced end of fin not reaching a vertical from the ventrals. Ventrals large, nearer to the first dorsal than to the second, hind margin little concave. Second dorsal more than half as large as the first, middle of base above origin of anal. Anal much smaller than second dorsal, base and acuminate extremity extending a short distance behind those of that fin, base about three fourths of its distance from the caudal. Caudal moderate, more than one fifth of the total length, subcaudal lobe feeble. Eggs large, not supplemented by a placental attachment.

Greyish to brownish grey, in most cases with few to many spots of white along the sides above the lateral line and with white hind borders to the fins; white below.

Total length 30, snout to abdominal pores 14, snout to fifth gill opening, $4\frac{3}{4}$, snout to mouth, $1\frac{7}{8}$, and caudal $6\frac{3}{8}$ inches. Nice, France, Col. Theodore Lyman.

Mediterranean and Eastern Atlantic.

Galeorhinus manazo.

Mustelus vulgaris Schlegel, 1850, Jap. Pisces, p. 303, pl. 134; Nyström, 1887, K. Svensk. vet. akad. handl., **13**, p. 50 extra.

Mustelus manazo Bleeker, 1854, Verh. Bat. gen., **26**, p. 126; Duméril, 1865, Elasm., p. 403; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 387; Day, 1878, Ind. fishes, p. 720, pl. 186, f. 3; Ishikawa & Matsuura, 1897, Cat. fishes, p. 62; Jord. & Snyder, 1900, Proc. U. S. nat. mus., **23**, p. 336; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 608.

? *Mustelus griseus* Pietschmann, 19 March, 1908, Anz. Akad. wiss. Wien, **45**, p. 132; 1908, Sitzb. Akad. wiss. Wien, **117**, p. 695, pl. 2, f. 1, 3.

Cynias mustelus Tanaka, 1911, Fishes of Japan, **3**, p. 47, pl. 12.

Snout somewhat pointed, length about two and one half times that of the mouth, or of the orbit. Nostrils entirely within the posterior half of the snout; anterior valve produced, rounded at the end. Mouth medium, width less than twice the length, more than two thirds of the length of the snout; upper labial folds about half the length of the jaw, lower shorter. Teeth small, convex on the crown, with a shallow concave indentation on the outer edge, like those of *G. mustelus*. Length of orbit less than half that of the snout, about equal width of largest gill opening. Hindmost gill opening small, above the pectoral. Pectoral large, if applied to the side subtending less than half of the base of the dorsal. Origin of the dorsal almost directly above the inner angle of the pectoral, farther back than that of *G. mustelus*, base less than half of the distance from the second dorsal, fin ending about one length of the orbit forward of the bases of the ventrals. Bases of the ventrals little nearer to the base of the first dorsal than to that of the second. Base of second dorsal three fourths of that of the first dorsal, or an equal part of the distance from the caudal. Origin of the anal slightly behind the middle of the base of the second dorsal, fin about half as large, length of base two thirds of that of either the second dorsal or of the distance from the subcaudal.

Greyish brown with small spots of white, above the lateral line, to uniform. As in *G. mustelus*, the species to which this one is most closely allied, the spots are small and particularly numerous on the lateral line, and it is said the eggs do not form a placental attachment.

Total length $32\frac{1}{2}$, snout to abdominal pores $15\frac{3}{4}$, snout to fifth gill opening $6\frac{3}{4}$, snout to mouth $2\frac{1}{4}$, and length of caudal 6 inches.

Tokio, Japan. Alan Owston.

Galeorhinus fasciatus, sp. nov.

Trunk moderately robust, body cavity about half of the total length; head broad, flattened below, tapering forward; snout broadly rounded at the end. Nostrils in the hindmost third of the snout, anterior valve with a rounded lobe. Eye small, orbit one fourth of the length of the snout, with a nictitating fold. Spiracle small, distant from the eye about half the length of the orbit. Mouth large, width more than twice the length, and more than three fourths of the preoral length of the snout. Labial folds extending nearly half the length of each jaw, lower longer than the upper. Teeth small, in pavement; crowns smooth, convex, without notch or indentation. Greatest width of gill openings

about twice the length of the orbit; hindmost opening above the pectoral. Pectorals short and broad, applied to the side not reaching to the middle of the base of the dorsal, width about seven eighths of the length, length of bases less than half the width of the fins; angles broad, rounded; hind margin almost straight. Dorsal origin a short distance behind the ends of the bases of the pectorals, base very long, about two thirds of its distance from the second dorsal, height of fin three fifths of the length of the base, upper angle blunt, hinder acuminate. Second dorsal not more than half as large as the first, similar in form, base equal to its distance from the caudal, end of base above the middle of the anal base. Base of anal half as long as that of the dorsal above it, distant its length from that of the caudal, nearly half of it extended behind the end of the base of the second dorsal. Caudal little more than one fifth of the total length, rather narrow; subcaudal with a notch behind it and with a very feeble lobe in front.

Back brown with narrow transverse bands of darker, separated by spaces of about equal width: one or a pair crossing the orbits, one across the spiracles, one on the nape, four between the nape and the dorsal, four or five on the base of the dorsal, six between the dorsals, three on the base of the second dorsal, and two or three between it and the caudal. A yellow spot in front of each eye above each orbit. Fins dark with narrow edgings lighter. Lower surfaces whitish. On a larger individual pairs of bands are more or less confluent and all are more indefinite, indicating a probable loss of the bands later in life.

Total length 20, snout to abdominal pores $10\frac{5}{8}$, snout to fifth gill opening $4\frac{3}{8}$, snout to mouth $1\frac{3}{4}$, and caudal $4\frac{1}{8}$ inches. Total length 25, snout to pores $12\frac{1}{2}$, snout to fifth gill opening $5\frac{3}{4}$, snout to mouth $2\frac{1}{8}$, caudal $5\frac{3}{4}$.

Types from Rio Grande do Sul, Brazil, collected by the Thayer Expedition.

Galeorhinus punctulatus.

Mustelus punctulatus Risso, 1826, Hist. nat., **3**, Poissons, p. 128; Müller & Henle, 1841, Plagios., p. 190; Moreau, 1881, Poiss. France, **1**, p. 316.

Form slender and elongate; head narrow, depressed; snout long, tapering, blunted at the end. Nostrils in the posterior third of the preoral length, anterior valve produced in a rounded lobe. Eye small, pupil horizontal, orbit two and two thirds times in the length of the snout. Mouth small, width equal two thirds of the length of the snout, or twice the length; labial folds short, less than half the length of the jaws, upper little longer. Teeth intermediate between those of *G. laevis* and those of *G. mustelus*: they are smooth but the cusps are rather

produced and angular and have a concave indentation on the outer edge, though they cannot be described as denticulate. Gill openings narrow, greatest width two thirds of the length of the orbit. Fins all concave on the hind margin and rounded on the outer angle. Pectorals rather small, applied to the side not reaching the middle of the dorsal base, width about two thirds of the length, inner angle about 90°, broadly rounded. Origin of the dorsal above the inner angle of the pectoral, height about three fourths of the length of the base, base length equal half the distance from the second dorsal, end of fin reaching a vertical from the ventrals. Base of second dorsal nearly equal that of the first, fin about half as large, middle of base above the origin of the anal. Anal extending about half the length of the orbit farther back than the second dorsal, length of base two thirds of its distance from the caudal. Caudal nearly one fifth of the total length; subcaudal lobe weak.

Total length $23\frac{3}{4}$, snout to abdominal pores 11, snout to fifth gill opening $4\frac{1}{4}$, snout to mouth $1\frac{1}{2}$, and caudal $4\frac{7}{8}$ inches.

Grey with scattered small spots of black; lower surfaces white; fins darker, subcaudal blackish toward lower edges.

This species has a longer snout, smaller eyes, a smaller mouth, smaller, less pointed pectorals, smaller dorsals and narrower gill openings than *G. mustelus;* its teeth are more deeply indented, its dorsal farther back and it has black spots instead of white. Compared with *G. laevis* the snout is longer, the mouth smaller, the teeth are not angularly notched, are without the denticles, the eyes and gill openings are smaller, the pectorals are shorter and less produced in the outer angle, less broad in the inner and the fins are not tipped with black.

Measurements from a specimen taken at Nice, France, by Col. Theodore Lyman.

Galeorhinus lunulatus.

Mustelus lunulatus Jordan & Gilbert, 1882, Proc. U. S. mus., **5**, p. 108; Jord. & Everm., 1896, Bull. 47, U. S. Mus., p. 28; Gilbert & Starks, 1904, Mem. Cal. acad. sci., **4**, p. 5, pl. 1, f. 1.
Galeus lunulatus Jordan, 1895, Proc. Cal. acad. sci., ser. 2, **5**, p. 382.

Body elongate, slender; head rather narrow; snout long, about one and one third times the width of the mouth, broadly rounded to a blunted point. Nostrils near the mouth, entirely in the posterior half of the snout; anterior valve with a short broadly rounded lobe. Eye large, length of orbit two fifths of the preoral length, that is, equal to the width of the largest gill opening. Mouth rather small, length more than half the width; labial folds short, less than half as long as a jaw, lower longer and extending farther forward. Teeth small, with

a low blunted apex on each side of which there is a shallow concave indentation, weaker on the inner side, apex more produced near the symphysis of the jaws. Pectoral large, subfalciform, outer angle produced, blunted, reaching below half or more of the dorsal base, inner angle about 90°, hind margin a deep concave. Origin of the dorsal little in front of the inner angle of the pectoral, base half as long as the interdorsal space, fin high, upper angle blunted, upper half of hind margin nearly vertical, hinder angle produced, not reaching a vertical from the ventrals by a length of the orbit. Second dorsal shaped like the first, base three fourths as long, or less than the distance from the caudal. Anal half as large as the second dorsal, base two thirds as long, origin below middle of second dorsal base, hind margin deeply indented, ends about half the length of the orbit farther back than those of the fin above it. Caudal as long as the head to the hindmost gill opening; subcaudal lobe moderate, with a concave hind margin.

Back ashy to greyish or olivaceous brown; whitish to yellowish below.

Gulf of California; Panama.

Galeorhinus antarcticus.

Mustelus antarcticus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 387; Parker, 1882, Trans. N. Z. inst., **15**, p. 219, pl. 30; McCoy, 1884, Zool. Vict., **9**, pl. 87; Parker, 1889, Trans. N. Z. inst., **22**, p. 331, pl. 19; Waite, 1904, Mem. N. S. Wales nat. club, no. 2, p. 7; 1907, Rec. Canterb. mus., **1**, p. 7; 1909, Rec. Canterb. mus., no. 2, p. 10, pl. 14, f. 2.

Head rather broad; snout broad, obtuse, in length about equal to width of mouth. Front edges of nostrils in the mid length of the snout; anterior valve with a somewhat produced and broadly rounded lobe. Mouth large, length equal that of orbit, width twice as much. Teeth smooth, broader than long, without a produced cusp but slightly concave on both outer and inner edges. Orbits less than half as long as the snout, with a nictitating fold. Width of largest gill opening half that of the mouth, smallest opening above the base of the pectoral. Pectorals large, width two thirds of the length, outer angle produced, blunted, fin applied to the side subtending nearly the entire base of the dorsal, inner angle rounded, hind margin concave. Dorsal origin above the inner angle of the pectoral, base equal nearly half the distance from the second dorsal, hind angle much produced but not quite reaching a vertical from the ventrals. Second dorsal base about equal to that of the first, fin smaller. Anal much smaller than second dorsal, origin below the middle of the latter's base, length less than the distance from the caudal. Caudal nearly one fifth of the total length; subcaudal lobe as long as the orbit, slightly blunted.

Ashy or greyish brown; white below.

Total length 37, snout to abdominal pores $17\frac{1}{2}$, snout to fifth gill opening 7, snout to mouth $2\frac{3}{8}$, caudal $7\frac{3}{4}$ inches.

Melbourne.

Galeorhinus laevis.

Plate **4**, fig. 6–9; Plate **60**, fig. 1–4.

Galeus laevis Rondelet, 1554, Pisc., p. 375; Salviani, 1554, Aquat., f. 137; Valmont, 1768, Dict. hist. nat., **2**, p. 102; Duhamel, 1782, Traité, **4**, sect. 9, p. 300.
Squalus mustelus Linné, 1758, Syst., **1**, p. 235 (part); 1766, Syst. nat., **1**, p. 400; Bonnaterre, 1788, Ichth., p. 7, pl. 7, f. 21.
Squalus canis Mitch., 1815, N. Y. lit. & philos. trans., **1**, p. 486.
Mustelus laevis Risso, 1826, Hist. nat., **3**, Poissons, p. 127; Müller, 1842, Abh. Akad. wiss. Berlin, p. 187, pl. 3, f. 1; Müller & Henle, 1841, Plagios., p. 190, pl. 27, f. 2; Duméril, 1865, Elasm., p. 401, pl. 3, f. 4–6; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 385.
Squalus (*Mustelus*) *laevis* Voigt, 1832, Thierreich, **2**, p. 508.
Mustelus equestris Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 49 (132) f. 2.
Mustelus vulgaris Müller & Henle, 1841, Plagios., p. 64 (part).
Mustelus canis DeKay, 1842, N. Y. fish., p. 355, pl. 64, f. 209; Storer, 1867, Mass. fish., p. 251, pl. 37; f. 2; Poey, 1868, Repertorio, **2**, p. 453; Jord. & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 870; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 29.
Mustelus megalopterus Smith, 1849, Afr. Pisces, pl. 2.
Pleuracromylon laevis Gill, 1864, Proc. Acad. nat. sci. Phil., p. 148.
Mustelus natalensis Steindachner, 1866, Sitzb. Akad. wiss. Wien, **53**, p. 482, pl. 1.
Mustelus hinnulus Jord. & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 19.
Rhinotriacis laevis Jord. & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 60.
Cynias canis Ribeiro, 1907, Arch. Mus. nac., **14**, p. 161, pl. 7.

Trunk long, slender; body cavity less than half of the total length; head narrow, depressed, flattened beneath; snout moderate, tapering, blunted at the end, in length greater than the width of the mouth. Nostrils large, distant from the mouth about half as far as from the end of the snout; anterior valve ending in a produced rounded lobe. Mouth twice as wide as long, subangular in front; labial folds well developed, less than half the length of the jaw, about equal. Teeth small, in pavement; cusp short, angular, with a shallow notch on the outer edge near the middle forming two denticles which vary in length and sharpness with age, sex, position, and use. Eye with a nictitating fold; pupil horizontally elongate; length of orbit nearly equal to the prenarial length of the snout, or to half of the preoral length, greater than the width of the gill openings or the length of the mouth. Fins concave on the hind margins. Pectorals two thirds as broad as long, outer and inner margins convex, angles blunted, outer angle less than 90°, inner greater, base narrow. Origin of dorsal little in advance of the hind margins of the pectorals, behind the ends of the pectoral bases, length of base nearly two and one third times in its distance from the second dorsal, height less than three fourths of the base, hind angle not quite reaching a vertical from the ventrals. Ventrals nearer to the first dorsal than to the second.

second dorsal more than half as large as the first, about twice as large as the anal, the origin of which is below the middle of the base and the produced extremity of which reaches farther back than that of the dorsal. Caudal little more than one fifth of the total; subcaudal lobe rather feebly developed but increasing with age; a notch behind the subcaudal. Eggs small, supplemented by a placental attachment.

Total length 23, snout to pores $10\frac{1}{2}$, snout to fifth gill opening $4\frac{1}{2}$, snout to mouth $1\frac{3}{8}$, and caudal 5 inches.

Back brown, light greyish to yellow or olive; young, up to two feet in length, commonly with black tips on dorsals and caudal and with light margins behind the fins; lower surfaces white to yellow or grey.

Described specimens from Nice, France, collected by Prof. C. Bellotti. Specimen figured from Long Island Sound, New York, secured by Eugene N. Fischer.

Galeorhinus californicus.

Mustelus californicus Gill, 1864, Proc. Acad. nat. sci. Phil., p. 148; Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 110; 1883, Bull. 16, U. S. nat. mus., p. 20, 370.
Mustelus hinnulus Jordan & Gilbert, 1881, Proc. U. S. nat. mus., **4**, p. 31.
Galeus californicus Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 30.

Head tapering from the spiracles; snout narrow but broadly rounded at the end, length one and one third times the width of the mouth, or two and three fifths times the length of the orbit. Nostrils entirely in the posterior half of the snout; anterior valve with a broad rounded lobe. Mouth medium; labial folds not half the length of a jaw, equal, lower extending farther forward. Teeth like those of *G. mustelus* broad with a shallow concavity on the outer edge and no denticle. Width of largest gill opening less than the length of the orbit. Pectorals broad, width two thirds of the length, outer angle rather sharp, not reaching below the middle of the dorsal base, inner broadly rounded, hind margin concave. Origin of the dorsal above the inner angle of the pectoral, base about half as long as the interdorsal space, end of fin reaching a vertical from the ventrals, hind margin somewhat oblique, upper angle blunted. Base of second dorsal four fifths as long as that of the first, or less than half the distance from the caudal, middle above the origin of the anal, fin shaped like the first dorsal. Base of the anal about two thirds as long as that of the second dorsal, extending half the length of the orbit farther back, nearly equal the distance from the caudal; caudal one fifth of the total length, subcaudal lobe weakly developed.

Ashy brown; lower fins with lighter borders; lower surfaces white.

Total length $25\frac{1}{2}$, snout to abdominal pores $11\frac{1}{2}$, snout to fifth gill opening $4\frac{3}{4}$, snout to mouth $2\frac{3}{5}$, and caudal $5\frac{1}{8}$ inches.

San Diego, California.

Galeorhinus dorsalis.

Mustelus dorsalis Gill, 1864, Proc. Acad. nat. sci. Phil., p. 149; Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 109.
Mustelus mento Cope, 1877, Proc. Amer. philos. soc., **17**, p. 47.
? Mustelis edulis Perez, 1886, Estud., p. 4; Philippi, 1887, Ann. Univ. Chile, **71**, p. 15, pl. 6, f. 5.
Galeus dorsalis Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 30; Gilbert & Starks, 1904, Mem. Cal. acad. sci., **4**, p. 7, pl. 1, f. 2.

Head tapering from the spiracles; snout rather sharp, blunted at the end. Nostrils near the mouth, entirely behind the mid length of the snout; anterior valve with a produced rounded lobe. Eyes small, length of orbit less than one third of that of the snout. Mouth moderate, width less than the preoral length of the head; labial folds rather short, lower a trifle the longer. Teeth differing on the two jaws: upper cusps oblique, apex sharply produced, inner edge straight or slightly concave, outer edge deeply notched; lower cusps more erect, less produced, with a concavity on each edge, rendering some of the teeth tricuspid. The lower teeth resemble those of *G. laevis*. Widest gill opening equal to more than length of orbit. Pectorals broad, obliquely subtruncate, angles rounded, inner broader, fin applied to the side reaching little behind the middle of the base of the dorsal. Origin of the dorsal about half way from the end of the base of the pectoral to the inner pectoral angle, length of dorsal base two thirds of the interdorsal space, hinder extremity reaching nearly or quite to a vertical from the ventrals, hind margin more oblique than that of the second dorsal. Second dorsal about half as large as the first, base three fourths as long and equal the distance from the caudal, hind margin little more erect than in first dorsal. Anterior four fifths of the anal base below the hindmost two thirds of that of the second dorsal, base of anal one and one half times its distance from the caudal. Caudal one fifth of the total length; subcaudal lobe slightly produced.

Olive to greyish brown on the back and fins; lower surfaces, from the eye and upper parts of the gill openings, white.

Total length of specimen described $19\frac{3}{4}$, snout to abdominal pores 10, snout to fifth gill opening $4\frac{1}{8}$, snout to mouth $1\frac{1}{4}$ and length of caudal 4 inches.

Panama.

Scylliogaleus.

Scylliogaleus Boulenger, 1902, Ann. mag. nat. hist., ser. 7, **10**, p. 51.

Body slender, compressed, shorter than the tail. Head broad, depressed. Snout broad, broadly rounded. Nostrils far apart, connected with the mouth by a groove; anterior valves broad, reaching to the teeth, narrowly separated from one another medially. Mouth regularly arched, with strong labial folds. Teeth small, in pavement, with flattened crown. First dorsal above the space between the pectorals and the ventrals, second above the anal. Caudal slender, not deep. Scales keeled.

Scylliogaleus quecketti.

Scylliogaleus quecketti Boulenger, 1902, Ann. mag. nat. hist., ser. 7, **10**, p. 51, pl. 4.

Snout broad, depressed, broadly rounded across the end, twice as broad as deep, in length equal distance from eye to gill opening or one and two thirds times the diameter of the eye. Spiracle small, diameter about equal the distance from the orbit. Nostrils near midway from mouth to end of snout; anterior valves broad, reaching the mouth, narrowly separated from one another in front of the symphysis. Mouth regularly curved, width much greater than the preoral length of the snout, with strong labial folds nearly half as long as the jaw. Teeth small, numerous, in pavement, with flattened feebly ribbed crowns. First gill opening about equal length of eye, fifth two thirds as much, hindmost two above the pectoral. Pectoral as long as its distance from the front of the eye, reaching behind the origin of the first dorsal. Ventrals small, origins equidistant from spiracle and caudal fin; claspers small, simple. Bases of dorsals about half as long as the interdorsal space; first dorsal about midway between bases of pectorals and those of the ventrals, hind margin deeply concave, hind angle produced. Second dorsal similar to the first, little smaller; hinder half of the base above the small anal. Base of anal about equal its distance from the caudal. Tail longer than the body, compressed, slender. Caudal two ninths of the total, notched below the terminal portion, angles rounded. Scales acutely pointed, keeled.

Grey above; white beneath; fins grey, caudal white edged.

Off coast of Natal, Africa, in about 40 fathoms.

Centraciontidae.

The living species of this family are small sharks which have short bodies and heads, blunt snouts, small spiracles below the hinder part of the eye, a narrow mouth near the end of the snout, with about four lobes in each half of the upper lip, both cuspidate teeth and grinders, five gill openings of which several are above the pectorals, eyes without nictitating membrane or folds, nostrils connected with the mouth by nasoral grooves, without cirri, two dorsals each preceded by a strong rigid spine, an anal behind the second dorsal, a short deep caudal, small carinate scales, a preorbital articulation between upper jaw and skull, and asterospondylic vertebrae.

Fossil species were present in the Jurassic or earlier; from what we now know of them they differed comparatively little from the recent forms.

Name from Κέντρον, a point, spine, spike, or spur, and Ἀκίς.

Centracion.

Heterodontus Blainv., 1816, Bull. Soc. philom., p. 121 (not *Heterodon* Latreille, 1802).
Les Cestracions Cuv., 1817, Reg. anim., **2**, p. 129 (not *Cestracion* Klein, 1742, 1776, or Walbaum, 1792).
Centracion Gray, 1831, Zool. misc., **1**, p. 5.
Heterodontus, *Tropidodus*, and *Gyropleurodus* Gill, 1862, Proc. Acad. nat. sci. Phil., p. 489.

Head short; snout blunt; crown narrowed, between strong orbital ridges. Eyes small, lateral. Nostrils with two thick valves reaching the mouth and curving toward the grooves. No narial cirri. Mouth narrow, with thick labial folds on both jaws. Teeth alike in upper and lower jaws, cuspidate in the anterior series, elongate longitudinally ridged grinders posteriorly.

Pectorals large, dorsals moderate, anal small, caudal short.

The nomenclature is discussed on page 4.

Base of anal fin two or more times its length from that of the caudal
origin of first dorsal above the middle of the base of the pectoral, hind margin deeply concave,
bands transverse, narrow . . . . . *zebra* (page 181)
Base of anal little less than twice its length from that of the caudal
origin of first dorsal above mid pectoral base; fin somewhat concave on hind margin
bands both transverse and longitudinal . . *philippi* (page 182)

Base of anal about one and one fourth times its length from that of the caudal
origin of first dorsal above the end of the pectoral base, hind margin concave (convex in second dorsal)
bands transverse, broad . . . . . *japonicus* (page 184)
Base of anal about two thirds of its length distant from the caudal
origin of first dorsal above the hind portion of the pectoral base, hind margin concave
bands transverse and broad to absent . . *galeatus* (page 185)
Base of anal nearly one length distant from the caudal
origin of first dorsal above the forward part of pectoral base, hind margin concave
spots black, small, scattered . . . . *francisci* (page 186)
Base of anal two thirds of its length distant from the caudal
origin of first dorsal behind the end of the pectoral base, hind margin convex
spots black, moderate, more or less grouped in twos and fours *quoyi* (page 187)

CENTRACION ZEBRA.

Plate **47**, fig. 4–6.

Centracion zebra GRAY, 1831, Zool. misc., **1**, p. 5.
Cestracion zebra RICHARDSON, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 195.
Heterodontus zebra GRAY, 1851, Chondropterygii, p. 65; BLEEKER, 1856, Act. Soc. sci. Ind. Neerl., 1, Amboina, p. 71; MACLAY & MACLEAY, 1886, Proc. Linn. soc. N. S. W., **10**, p. 673, pl. 45.
Cestracion philippi GÜNTH., 1870, Cat. fishes Brit. mus., **8**, p. 415 (part).
Cestracion amboinensis REGAN, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 436; 1908, ibid., ser. 8, **1**, p. 497.
Cestracion zebra REGAN, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 496.

Body and head more slender, head more pointed and fins longer than those of other species of the genus. In a 19 inch female the body cavity is less than half of the total length. Head one fifth of the total, orbital ridges strong, low; snout blunt. Orbit elongate, half of interorbital space, more than one third of snout. Spiracle small, below the hind edge of the orbit. Mouth narrow, with labial folds on both jaws; lower folds as long as the space separating them; upper very short, not reaching half way to the narial valves; with a short groove behind the angles. Teeth in young quincuspid, becoming tricuspid with acquisition of the molars; molars elongate with a longitudinal keel. This keel, in the specimen described, lies more to the outer side of the tooth than on such species as *C. quoyi* and *C. francisci;* it is as if the tooth were turning outward to present more of its inner side as a grinding surface. On older specimens the cusps and keels are worn away, the molars are more swollen and the symphyses are proportionately

longer, but not so much so as on *C. philippi*. As the molars increase in width the symphyses become longer.

Anterior gill openings wide, one and one half times the length of the orbit; hindmost one third as wide as the foremost, three above the base of the pectoral.

Dorsals very high, length of base nearly half the height of the fin, hind margins deeply concave, hind angles acute. Origin of first dorsal above the middle of the base of the pectoral, base ending twice its length forward from the second dorsal. Second dorsal smaller than first, its base being one fourth shorter, origin behind the end of the bases of the ventrals. Anal smaller than second dorsal and origin little backward from the base of that fin; base more than twice its length forward from the caudal, tip when applied not reaching the caudal by one length of the base. Pectorals broad, longer than the head, hind margins nearly straight, outer angle rather pointed. Caudal elongate, as long as the distance from snout to first dorsal; subcaudal fin deep, hind margin concave.

Light yellowish to reddish brown, darker on the back, lighter on the young, with transverse bands of darker, alternating wider and narrower, or the wider split into a pair of which the lower extermities are more or less curved and united. A V-shaped band on the snout, behind this a straight bar separating it from the orbital pair, the portions of each of which below the eye are again divided. The second pair of bars is on the nape, the third in front of the dorsal spine, the fourth behind the fin, the fifth in front and the sixth and seventh behind the second dorsal, the eighth is at the root of the caudal and others are on the caudal fin. In the main these markings agree closely with those on Plate 45 of Maclay & Macleay, 1886. Slight differences may be seen in the interorbital bands, which do not extend so far forward by half, in their suborbital extremities, which are split, and, while the pair immediately in front of the second dorsal are joined below the flank as on the plate, the two pairs behind the spine of this fin are similarly united.

Described from a female of nineteen inches from China.

China to the East Indies.

Centracion philippi.

Port Jackson shark Phillipp, 1789, Voy. Botany Bay, p. 283, fig.
Le Squale Philipp Lacépède, 1798, Poissons, 1, p. 218.
Squalus philippi Schneider, 1801, Bloch Ichth., p. 134.
Heterodontus philippi Blainv., 1816, Bull. Soc. philom., p. 121; Gray, 1851, Chondropterygii, p. 66; Gill, 1862, Proc. Acad. nat. sci. Phil., p. 486.
Cestracion philippi Cuv., 1817, Reg. anim., **2**, p. 129; Lesson, 1830, Voy. Coquille, Poiss., p. 97, pl. 2;

Agass., 1835, Rech. poiss. foss., **3**, p. 8, pl. D, fig. 11–16; Owen, 1845, Odont., pl. 10, f. 1, pl. 11, fig. 2–4; pl. 12–13; Strüver, 1864, Nov. act. Acad. Leop., **23**, 32 pp.; McCoy, 1886, Zool. Vict., pl. 113.

Heterodontus phillipi Duméril, 1865, Elasm., p. 424; Maclay & Macleay, 1878, Proc. Linn. soc. N. S. W., **3**, p. 309, pl. 22–24; Waite, 1899, Mem. Austr. mus., **4**, p. 30.

Cestracion philippi Günth., 1870, Cat. fishes Brit. mus., **8**, p. 415 (part).

Cestracion phillippi Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 495.

Massive and angular anteriorly, head and body nearly half of the total length; head about one fourth, crown deeply concave tranversely, orbital ridges strong, ending abruptly at the occiput, slightly diverging and rising backward; snout elongate, blunt; caudal shorter than the head. Length of orbit about one fourth of its distance from the end of the snout; eye small, lateral, at the top of the skull. Spiracle small, below the orbit and immediately behind a vertical from the posterior edge. Mouth narrow, with labial folds on both jaws, upper shorter, reaching half way to the narial valve; with a short cleft at the angle extending behind the folds. Teeth cuspidate in the young, tricuspid in large, if not too much worn, in the anterior series; molars more or less swollen and widened in the larger individuals, with longitudinal keels as newly acquired, or in young specimens. Symphyses of jaws more elongate than in other species, near two fifths of the jaws, bringing the halves of the jaws nearly parallel for that distance, thus placing the swollen molars close to their opposites between the ends of the symphyses. Narial valves and nasoral grooves as in other species of the genus; the valves end in thin folds at the teeth. Gill openings wide, anterior three times the length of the orbit, hindmost two fifths as wide as the first, three above the base of the pectoral. Dorsals moderate, upper angles broadly rounded, hind margins somewhat concave, hinder angle slightly produced, heights about equal to length of bases. Origin of the first dorsal above the middle of the base of the pectoral, base distant from origin of second dorsal, twice the length. Second dorsal smaller, base twice in its distance from the caudal, origin above tips of ventral fins, tip extending little beyond the origin of the anal. Anal smaller than second dorsal, origin about the width of the orbit behind the end of the base of the second dorsal, base twice its length from the origin of the subcaudal, end of fin subtruncate. Claspers twice as long as the free portion of the ventral, stout, pointed, with a strong spine in the distal joint. Scales small, with a median keel, very small and smooth on the lower surfaces.

Light reddish brown to brown; a dark band across the orbits to the cheeks, a dark band on each side from the occiput backward to a transverse bar in front of the dorsal spine, thence passing down and back to the base of the ventral after sending a V-shaped branch to the base of the pectoral; these bands sometimes

fuse on the nape, or meet a transverse bar. A darker median dorsal band extends from the first dorsal backward. In cases a stripe passes along the flanks at each side of the dorsals. Triangular areas of lighter color are included by the bands behind the head, on the nape, and on the side of each shoulder, ventral surfaces yellowish. Edges of fins lighter.

McCoy, 1886, figures a specimen as light rusty greyish brown with barely a trace of the bands. From the number of series of molars this was an aged specimen yet they retain the longitudinal ridges. The specimen described here is a male, about 34 inches long, from New Holland, sent by Mr. G. Krefft.

Queensland; Southern Australia; New Zealand.

Centracion japonicus.

Cestracion phillipi Müller & Henle, 1841, Plagios., p. 76, pl. 31.
Cestracion philippi Schlegel, 1850, Jap. Pisces, p. 304.
Heterodontus zebra Bleeker, 1854, Verh. Bat. gen., **26**, p. 127.
Cestracion phillipi var. *japonicus* Duméril, 1865, Elasm., p. 426.
Cestracion philippi Günth., 1870, Cat. fishes Brit. mus., **8**, p. 415 (part).
Heterodontus japonicus Maclay & Macleay, 1878, Proc. Linn. soc. N. S. W., **8**, p. 428, pl. 20; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 599.
Cestracion japonicus Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 496.

Stout and heavy anteriorly, tapering behind the pectorals. Head blunt, more convex forward than that of *C. philippi* or *C. zebra*, nearly one fourth of the total; orbital ridges moderately high, strong, ending less abruptly than those of *C. philippi*. Orbit about one third of length of snout, two fifths of interorbital space.

Spiracle below the orbit and behind a vertical from its hind border. Mouth narrow, with labial folds separated at the symphysis by less than the length of the lower fold, upper fold reaching less than half the distance to the narial valve. A short straight oblique groove behind the angle of the mouth. Anterior teeth cuspidate, tricuspid or on very young five cusped, posterior molars elongate, somewhat swollen, carinate before much used. Symphyses hardly so long as those of *C. philippi*, branches of the jaws little more divergent. Hindmost gill opening equal length of orbit, foremost twice as much, three openings above the pectoral. Height of dorsals greater than length of bases, upper angles rounded, hinder slightly produced, hind margins concave. The shape of the first dorsal approaches that of the same fin in *C. zebra* more than that of the second, which is more like the first dorsal of *C. philippi*. Origin of the first dorsal above the end of the base of the pectoral, its base separated by more than twice its length from that of the second dorsal. Second dorsal smaller, originating about one

length of the orbit behind the bases of the ventrals, its base distant two lengths or more from the origin of the caudal, hind margin less concave than that of the first dorsal. Anal smaller, base equal two thirds of base of second dorsal, hind margin oblique, slightly concave, an obtuse rounded inner angle, fin hardly reaching origin of subcaudal when applied, base distant one and one half times its own length. Caudal shorter than the head, deep in anterior portion, which is produced to a shape in some degree like that of a dorsal fin, concave in hind margin. Ventrals broad, short, hind margins oblique. Pectorals long, hardly reaching the origin of the ventrals, outer angle rounded, hind margin oblique, slightly concave. Scales small, with a median keel; mixed with larger, irregular, subquadrangular scales, with or without small lateral prominences in the dorsal regions, very small and smoother on the lower surfaces.

Dark rusty brownish, with darker areas on the end of the snout, in a trans-orbital band that widens below the eyes, and in broad and narrower bands across the back: first broad band across the nape, second and third at the origin and at the tip of the first dorsal, fourth, and fifth at the origin and tip respectively of the second dorsal, sixth at the tip of the anal and seventh on the caudal; the intermediates are somewhat narrower. Fins dark. Gill openings narrowly edged with white. Lower surfaces slaty to yellowish.

The specimen described is a female of about 30 inches from the Sagami Sea, Japan.

Centracion galeatus.

Cestracion galeatus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 416.
Heterodontus galeatus Maclay & Macleay, 1878, Proc. Linn. soc. N. S. W., **3**, p. 313, pl. 25.
Gyropleurodus galeatus Waite, 1899, Mem. Austr. mus., **4**, pl. 1; Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 495.

Form similar to that of *C. francisci*. Orbital ridges strongly developed, extending outward so as to overhang the orbits, ending with some degree of abruptness. Teeth tricuspid, on large specimens, probably like the other species of the genus when young possessing a larger number of cusps; molars elongate, narrow, not swollen laterally as in *C. philippi*, and retaining the median keel. Anterior gill opening more than twice as wide as the hindmost, three above pectoral base. Origin of the first dorsal above the hinder portion of the base of the pectoral, extremity reaching beyond the origin of the ventrals.

Second dorsal smaller, less than twice the length of the base of the first dorsal farther back ($1\frac{2}{3}$), tip reaching above origin of anal.

Anal smaller than second dorsal, origin one length of the base farther back

than the end of the base of the second dorsal, below the end of the free extremity of the latter. Base of anal less than its length forward from the origin of the subcaudal, which latter is reached by the inner angle of the fin. Caudal shorter than the head; subcaudal deep, short, hind margin nearly vertical, straight. Pectorals large reaching beyond origin of ventrals.

Brown, with a transverse band of darker across the orbits, widening upon the cheek; another band in front and one behind the ventrals, one through the second dorsal and one in front of the anal, less definite than the anterior.

New South Wales.

Centracion francisci.

Plates **45–46.**

Cestracion francisci Girard, 1854, Proc. Acad. nat. sci. Phil., p. 196; 1858, Rept. Pacif. R. R. Fish., p. 365; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 416.
Heterodontus francisci Gill, 1860, Amer. journ. sci., ser. 2, **30**, p. 281; Maclay & Macleay, 1878, Proc. Linn. soc. N. S. W., **3**, p. 315, pl. 26.
Gyropleurodus francisci Gill, 1862, Proc. Acad. nat. sci. Phil., p. 330, 490; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 33; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 20; Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 494.
Heterodontus (*Cestracion*) *francisi* Duméril, 1865, Elasm., p. 426.

Head short, angular, with strong orbital ridges, divergent backward, ending abruptly behind the occiput in young, less so in old. Crown concave transversely. Snout short, steep, blunt. Nostrils near the end of the snout, connected with the mouth by nasoral grooves; anterior nasal valves narrow, reaching the mouth, not connected across the internarial space, curving outward posteriorly, posterior forming a fold at the outer side of the nostril and curving inward posteriorly to meet the upper labial fold on the outer side of the nasoral groove. Mouth narrow, with short labial folds on both jaws, lower widely separated behind the symphysis, upper extending about three fifths of the distance from the angle to the narial valve. A short groove behind each angle of the mouth. Anterior teeth small, compressed, with about five cusps, median largest; with age the outer cusps become less apparent and the median cusp much stronger. Some of the molars are much elongated on large examples, nearly three times as long as wide; all of them have a longitudinal keel, with age they become wider and make more of an approach toward those of the other branch of the same jaws. The symphyses are shorter in the young than on older individuals. Eye small, lateral, farther back than the mouth, without nictitating membrane or fold. Spiracle small, below and little behind the eye. Anterior gill opening three times as wide as the posterior, width of the latter nearly equal to the length of

eye. Dorsals moderate, height greater than length of base; upper angles broadly rounded, posterior slightly produced, hind margin concave; spines strong, with long bases. Origin of first dorsal above middle of pectoral, middle of base including spine above end of pectoral base. Distance between bases of first and second dorsals nearly two and one half lengths of the base of the first. Origin of the second dorsal above the tips of the ventrals, base distant one length from origin of caudal. Fin angles more produced in old specimens. Anal small, applied the tip of the fin reaches the subcaudal, origin little behind the end of the base of the second dorsal, base distant one length from the origin of the caudal. Pectorals broad, tip reaching the ventrals. Subcaudal short, about twice as long as deep.

Greyish or olivaceous brown with scattered spots of black, smaller than the orbit to mere dots, over body and fins. On large specimens the spots are sometimes absent or nearly so. Yellowish beneath.

Snout longer on old males.

West coasts of California and Mexico.

Centracion quoyi.

Plate **47**, fig. 1–3.

Cestracion quoyi Freminville, 1840, Mag. zool., ser. 2, **2**, pl. 3; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 416.
Cestracion pantherinus Valenciennes, 1845, Voyage Venus, Zoology, pl. 10, f. 2; 1855, ibid., Texte, p. 350.
Tropidodus pantherinus Gill, 1862, Proc. Acad. nat. sci. Phil., p. 486.
Heterodontus (Cestracion) quoyi Duméril, 1865, Elasm., p. 427.
Heterodontus quoyi Maclay & Macleay, 1878, Proc. Linn. soc. N. S. W., **3**, p. 316, pl. 26, f. 35.
Gyropleurodus quoyi Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 21; Regan, 1908, Ann. mag. nat. hist., ser. 8, **1**, p. 494.

Body cavity about one half of the total length in an eighteen inch female, rather more stout than a specimen of *C. zebra* of equal length. Head one fourth of the total, snout blunt, cheeks swollen, orbital ridges low, strong, somewhat overhanging the orbits, not ending as abruptly as in *C. francisci*. Eye small, length of orbit less than $\frac{1}{3}$ of orbital width of crown, less than one third of length of snout. Spiracle small, below and slightly behind the orbit. Mouth narrow; both jaws with labial folds, lower longer, widely separated behind the isthmus, upper short, reaching little more than halfway to the narial valve; no fold behind angles and labials. Anterior teeth tricuspid, except in very young; molars elongate, narrow, with a longitudinal ridge; Symphyses much shorter than those of *C. philippi*. On the teeth of the specimen figured on Plate **47**,

fig. 2–3, the molars retain the keel; in old ones the keel would be less noticeable. Anterior gill openings more than twice as wide as the hindmost, latter width equals length of eye, three above the pectoral. Dorsals moderate, height about equal length of base, upper angles bluntly rounded, hind margins convex, lower angles not produced; origin of first dorsal behind the end of the base of the pectoral, distance between the bases one and two thirds times the length of the base of the first. Anal much smaller than the second dorsal, tip reaching the base of the caudal, base distant nearly two thirds of its length from the caudal, hind margin oblique, tip rounded. Subcaudal moderate in depth, with a slight lobe. Pectorals short, broad, angles rounded, hind margin nearly straight. Ventrals broad, hind margin slightly oblique. Scales small, with median keel, larger, with scattered small tubercles on the back, smoother below. Back rusty brown, yellow below, with scattered spots of black, from mere dots to spots as large as the orbit or larger, over the entire body and fins. Commonly the spots show a tendency toward grouping in twos or fours; in cases they are more confluent. On some there are five or six rather indefinite transverse bands of darker separated by spaces of equal width: a band crosses the nape, another lies in front and a third behind the first dorsal, one in front and one behind the second dorsal and one in front of the caudal. A darker area extends from each orbit across each cheek.

Galapagos Islands.

Squalidae.

Body subround; tail slender, compressed. Head depressed; rostral cartilage a simple trough-shaped process of the skull. Nostrils remote from the mouth. Mouth not greatly arched, with labial folds and a deep groove at each angle, slightly protrusible, upper jaws loosely articulated to the skull. No nictitating membrane. Spiracles present. Five gill clefts in front of each pectoral. Two dorsal fins, each preceded by a spine. No anal fin. Vertebrae more or less calcified.

Dorsal spines without lateral grooves; no notch below the terminal part of the caudal

inner angles of pectorals not produced

body subtriangular, a dermal fold at each side

teeth unlike; first dorsal spine inclined forward

Oxynotus (page 189)

body subround; dermal folds on the tail, if present

teeth alike in the two jaws . . . *Squalus* (page 191)

Dorsal spines with lateral grooves; a notch below the terminal fin
teeth one cusped, unlike in the two jaws; nostrils oblique
inner angle of the pectorals produced
scales subsessile, with converging keels and stout peduncle
Centrophorus (page 196)
inner angle of pectorals not produced; nostrils oblique
scale crowns pinacoid, rounded, excavated or smooth, on slender peduncles . . . . . *Centroscymnus* (page 203)
scale crowns clypeoid, keeled or grooved
upper teeth in three groups . . *Centroselachus* (page 206)
scales pedunculate, with three strong, produced keels
Scymnodon (page 207)
inner angles of pectorals not or hardly produced; nostrils transverse
scales leaf-shaped, stalked, with a strong median keel
Lepidorhinus (page 211)
scales tricuspid, tridigitate, slender in stalk and cusp
snout much produced . . *Acanthidium* (page 215)
teeth pluricuspid; nostrils slightly oblique
scales unicuspid, slender, pointed
teeth pluricuspid in the upper jaws only
Etmopterus (page 221)
teeth pluricuspid in both jaws . *Centroscyllium* (page 230)

Oxynotus.

Oxynotus Rafinesque, 1810, Indice, p. 45, 60.
Centrina Cuv., 1817, Reg. anim., 2, p. 130.

Body stout and subtriangular in the middle, slender and compressed in the tail. Head small, depressed, flattened somewhat on the crown. Snout broad, obtuse. Nostrils anterior, valves broad. Mouth transverse, with labial folds and grooves, and a lip. Teeth unlike in the two jaws; upper slender, in a narrow group; lower compressed, triangular, serrated, functional in single series, except, perhaps, when about to be shed. No nictitating folds. Spiracle rather large. Two dorsals, with deeply imbedded spines, the anterior spine rising obliquely forward. No anal fin. Scales uniform, rough. Fossil in Pliocene.

Interdorsal space long, nearly twice the length of second dorsal
scales three cusped . . . . . *centrina* (page 190)
Interdorsal space short, equal length of second dorsal
scales five cusped . . . . . *bruniensis* (page 191)

Oxynotus centrina.

Regnard de mer Belon, 1551, Hist. nat. poissons marins, p. 46 bis, fig.
Vulpecula Belon, 1553, Aquat., p. 63, 64, fig.
Centrina Rondelet, 1554, Pisc., p. 384, fig.; Salviani, 1554, Aquat., f. 157, pl. 56–57; Gesner, 1558, Aquat., p. 718; Aldrovandi, 1613, Pisc. & Cet., p. 401; Willughby, 1686, Pisc., p. 58, pl. B 2, B 3.
Galeus centrina Gesner, 1558, Aquat., p. 1250; Jonst., 1649, Pisc., pl. 7, f. 4–5, pl. 31, f. 1; Klein, 1779, Neuer schaupl., 8, p. 380.
Squalus no. 5 Artedi, 1738, Ichthyologia, Syn., p. 95, Gen., p. 67.
Galeus sp. no. 7 Klein, 1742, Hist. pisc., miss., 3, p. 10.
Squalus centrina Linné, 1758, Syst., 1, p. 233; Brünnich, 1768, Ichthy. Massiliensis, p. 3; Bloch, 1785, Ausl. fische, 1 p. 23, pl. 115; Bonnaterre, 1788, Ichth., p. 12, pl. 5, f. 13; Schn., 1801, Bloch Ichth., p. 26; Risso, 1810, Ichth. Nice, p. 42.
Le Humantin Broussonet, 1780, Mem. Acad. roy., p. 676.
La Mielga Cornide, 1788, Peces, p. 128.
Le squale humantin Lacépède, 1798, Poissons, 1, p. 276, pl. 9, f. 3.
Oxynotus centrina Rafinesque, 1810, Indice, p. 45, 60; Gill, 1861, Ann. N. Y. lyc., 7, p. 405; Duméril, 1865, Elasm., p. 444, pl. 5, f. 8–9.
Acanthorinus centrina Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 61, pl. 15, f. 1.
Centrina centrina Cuv., 1817, Reg. anim., 2, p. 130.
Centrina humantin Cloquet, 1820, Dict., 7, p. 385, pl. 31.
Centrina salviani Risso, 1826, Hist. nat., 3, Poissons, p. 135; Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 58, f. 2; Müller & Henle, 1841, Plagios., p. 87; Bocage & Capello, 1866, Plagios., p. 32; Capello, 1870, Jor. Acad. sci. Lisboa, 2, p. 145; Günth., 1870, Cat. fishes Brit. mus., 8, p. 417; Day, 1884, Brit. fishes, 2, p. 319, pl. 161.
Centrina vulpecula Moreau, 1881, Poiss. France, 1, p. 355.

Body rather short and massive, transversely trihedral, having a dermal fold at each side of the belly and a weaker one between the dorsals and behind the head. Head small, short, depressed. Snout broadly rounded; nostrils near the end, anterior nasal valve broad, not lobed. Mouth small, transverse, with a deep groove at each angle passing in front of the teeth but not meeting the groove of the opposite side. Labial folds occur on both jaws; the anterior pair are separated in front by a V-shaped fold of the skin; hinder pair short and thick, each fold meeting a distinct lower lip that crosses behind the teeth. Upper teeth in a group, of ten rows on a specimen at hand, slender, compressed, pointed; lower teeth in nine rows, broad and subquadrangular in the base, triangular and serrate-edged in the cusp, median tooth erect, lateral teeth oblique. Eyes small; no nictitating folds. Spiracles large, behind the eye. Gill openings small, in front of the pectoral. Pectorals small, more than twice as long as wide, inner angle hardly indicated, not reaching to the end of the dorsal fin. Dorsal spines strong, deeply imbedded in the fin, apex only exposed. First dorsal large, length and height about equal to length of the front edge of the pectoral, base above that of the pectoral in front; base of the spine in the hinder third of the base of the fin, whence it inclines forward. Second dorsal about half as large as the first, base nearly twice its length farther back, about one length from the caudal. Ventrals short and broad, bases below the middle of the base of the second dorsal. Caudal

little more than twice as long as deep, vertebral axis rising backward, terminal portion of fin separated from the subcaudal by a shallow indentation, subcaudal lobe not produced. Scales rough, tricarinate, median keel produced and sharp, lateral keels short.

Back brown, edges of fins lighter; lower surfaces light.

Description from an eighteen inch specimen taken in the Mediterranean.

Oxynotus bruniensis.

Centrina bruniensis Ogilby, 1893, Rec. Australian mus., **2**, p. 62.
Oxynotus bruniensis Waite, 1907, Rec. Canterb. mus., **1**, p. 8.

Back and sides rounded, belly flattened. Head small, strongly depressed; snout short, obtuse, nostrils halfway from the eye to the end. Eye large, midway from the first gill opening to the end of the snout. Spiracles large. Mouth small, transverse, lateral grooves broad and deep. Upper jaws with a patch of small, conical, curved teeth of about four irregular series; lower teeth in a single series of larger, erect, compressed, minutely serrated, scalpriform teeth. Gill openings small, in front of the pectoral. Origin of first dorsal above the third gill opening, height of fin equal to the distance between the end of the snout and the first gill opening; spine equal to length of head in front of the spiracle, rising straight with a slight forward inclination, its base in the anterior portion of the last fourth of the base of the fin, midway from the end of the snout to the caudal fin. The distance between the bases of the dorsals is little more than the length of the base of the first dorsal in front of the spine. Second dorsal smaller than the first, basal length equal to interdorsal space and to height of fin. Pectorals pointed, length of front margin equal to the distance from the nostril. Origins of the ventrals below the spine of the second dorsal, the distance from their ends to the caudal equal to that between the second dorsal and the caudal. Caudal well developed. Scales rough, with a central spine from which radiate four compressed wings, each terminating in a shorter spine.

Uniform sandy brown.

Distinguished from *O. centrina* by the great height of the dorsal fins, their distance from one another, and by the scales.

Type from Bruny Island, Tasmania.

Squalus.

Squalus Linné, 1735, Syst. nat. (part); Artedi, 1738, Ichthyologia (part); Linné, 1758, Syst., **1**, p. 233 (part).
Dalatias Rafinesque, 1810, Caratteri, p.10 (part).

Acanthorhinus Blainv., 1816, Bull. Soc. philom., p. 121 (part).
Spinax Cuv., 1817, Reg. anim., **2**, p. 129 (part).
Acanthias Risso, 1826, Hist. nat., **3**, Poissons, p. 131 (part).

Body elongate, subround, longer than the tail. Head flattened below. Snout produced, tapering; nostrils transverse, remote from the mouth, inferior. Orbit lateral, elongate. Spiracles behind the eye at a higher level. Mouth wide, little arched, with a deep groove and with labial folds at each angle. Teeth compressed, sectorial, alike in the two jaws, with oblique cusp and with cutting edge nearly parallel to the edge of the jaw. Gill openings in front of the pectoral. Each dorsal preceded by a spine which is not grooved on the sides, anterior near the pectorals, posterior behind the ventrals. Tail with a pit at the root of the caudal. Caudal with a produced subcaudal lobe, and without a notch below the terminal portion. From Upper Cretaceous.

Dorsal spine behind and remote from the inner angle of the pectoral
acanthias (page 192)
Dorsal spine opposite or little behind the inner angle of the pectoral
sucklii (page 194)
Dorsal spine near the axil of the pectorals, between the inner margins
fernandinus (page 195)

Squalus acanthias.

Plate **14**, fig. 1–4; Plate **43**, fig. 9–10; Plate **59**, fig. 1–2.

Ἀκανθίας γαλεὸς Aristotle, Hist. anim., book VI, c. 10, book IX, c. 37.
Galeus acanthias Rondelet, 1554, Pisc., p. 373; Gesner, 1558, Aquat., p. 716; Jonst., 1649, Pisc., p. 27, pl. 8, f. 5; Klein, 1742, Hist. pisc., miss., **3**, p. 8, pl. 1, f. 5, 6; Duhamel, 1782, Traité, **4**, sect. 9, p. 299, pl. 20.
Squalus sp. Artedi, 1738, Ichthyologia, Syn., p. 94, Gen., p. 66, no. 3, Descr. p. 102, no. 1; Gronow, 1754, Mus., **1**, p. 61, no. 134; 1763, Zoophy., **1**, p. 34, no. 149.
Squalus acanthias Linné, 1754, Mus. Adol. Frid., p. 53; 1758, Syst., **1**, p. 233; 1766, Syst., **1**, p. 397; Bloch, 1784, Fische Deutschl., **3**, p. 74, pl. 85; Bonnaterre, 1788, Ichth., p. 11, pl. 5, f. 12; Schn., 1801, Bloch Ichth., p. 135; Donovan, 1805, Br. fish., pl. 82; Turton, 1807, Fauna, p. 114; Risso, 1810, Ichth. Nice, p. 40; Faber, 1829, Fische Islands, p. 29; Jenyns, 1835, Man., p. 505; Fries & Ekström, 1836–57, Skand. fisk., p. 187, pl. 46; Gray, 1854, Gron. syst., p. 8; Jord. & Gilb., 1882, Bull. 16, U. S. nat. mus., p. 16; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 54; Jensen, 1907, Dan. fiske, p. 308, pl. 28, f. 3; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 46.
The picked dog Brookes, 1763, Nat. hist., **3**, p. 32; Pennant, 1769, Zool., **3**, p. 77; Yarrell, 1836, Brit. fishes, **2**, p. 400; Couch., 1867, Brit. fishes, **1**, p. 49, pl. 11.
L'aiguillat Broussonet, 1780, Mem. Acad. roy., p. 673; Lacépède, 1798, Poissons, **1**, p. 270.
Spinax acanthias Cuv., 1817, Reg. anim., **2**, p. 130; Richardson, 1836, Faun. Bor. Amer., **3**, p. 291; Parnell, 1838, Mem. Wern. soc., **7**, p. 420; Storer, 1839, Report fishes, p. 187; Bonaparte, 1841, Icon. Fauna Ital., Pesci; DeKay, 1842, N. Y. fish., p. 359, pl. 64, f. 210; Ayres, 1842, Bost. journ. nat. hist., **4**, p. 288; Selys, 1842, Fauna Belge, p. 229.
Acanthias vulgaris Risso, 1826, Hist. nat., **3**, Poissons, p. 131; Müller & Henle, 1841, Plagios., p. 83; Kröyer, 1853, Danm. fiske, **3**, p. 868; Nilsson, 1855, Fisk. Skand., **4**, p. 731; Kessler, 1859, Bull. Soc. nat. Mosc., **2**, p. 473; Duméril, 1865, Elasm., p. 437; Bocage & Capello, 1866, Plagios., p. 21;

Günth., 1870, Cat. fishes Brit. mus., **8**, p. 418; Canestrini, 1872, Ital. pesci, p. 39; Malm, 1877, Göteb. och Bohus. fauna, p. 624; Gerv. & Boul., 1877, Poiss. Fr., **3**, p. 206, 207, pl. 79; Moreau, 1881, Poiss. France, **1**, p. 342; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 86; McCoy, 1883, Zool. Vict., pl. 75; Day, 1884, Brit. fishes, **2**, p. 315, pl. 160, f. 2.

Squalus (Acanthorhinus) acanthias Blainv., 1830, Poiss. Fr., p. 57.

Squalus (Spinax) acanthias Voigt, 1832, Thierreich, **2**, p. 510.

Acanthias acanthias Bonaparte, 1839, Mém. Soc. sci. Neuch., **2**, p. 8 extra.

Acanthias americanus Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 254; Gill, 1861, Proc. Acad. nat. sci. Phil., p. 60 extra; Storer, 1867, Mass. fish, p. 256, pl. 38, f. 1.

Acanthias sp. Richardson, 1848, Erebus & Terror, Fish, p. 44, pl. 28, f. 1–2.

Squalus americanus Gill, 1864, Proc. Acad. nat. sci. Phil., p. 263.

? *Acanthias lebruni* Vaillant, 1888, Cap. Horn Poissons, p. 13, pl. 1, f. 2.

Head one fifth of the total length, depressed. Snout tapering, nearly half as long as the head, blunted at the end; nostrils little nearer to the end than to the mouth, anterior valve short, longer and forming a sharp angle at the outer edge, hardly notched in the middle, where the process is rudimentary or absent. Orbit little farther from the first gill opening than from the end of the snout, length two fifths of that of the snout, little more than the internarial width, rounded in front. Mouth with a short deep groove and with labial folds at each angle, width two thirds of the preoral length. Teeth with cutting edges nearly transverse, upper narrower and little more oblique. Spiracle moderate, one diameter farther back than the eye, opening upward. Width of gill openings about half the length of the orbit, fifth widest, in front of the pectoral. Pectorals subtriangular, broader than long, hind margin slightly concave, hind angles rounded, fin applied to the side hardly reaching behind the dorsal spine. Spine of the first dorsal on a vertical one length of the orbit farther back than the inner angle of the pectoral, length less than half the height of the fin; hind margin of fin slightly concave, hind angle produced, base less than height of fin, one fifth of the distance from the second dorsal, little more than one third of the distance between the bases of second dorsal and caudal. Base of second dorsal more than two thirds as long as that of the first dorsal; spine longer than that of the first, nearly as high as the fin; hind margin of fin concave, upper angle rounded, hinder produced. A rudimentary dermal fold on each side of the tail opposite the hinder half of the space between the second dorsal and the caudal. Caudal twice as long as deep, subcaudal lobe produced, hinder margin of subcaudal and terminal broadly rounded to the blunted extremity. Ventral origins about midway from those of the pectorals to the origin of the caudal, much nearer to the origin of the second dorsal than to that of the first dorsal.

Back brown; lower surfaces white; with two series of white spots on each flank, varying in numbers and shapes; commonly there is a pair near the front of each dorsal and another behind, and those of the lower series are much elongate.

Young with lighter margins on the fins.

Specimen described, from Havre, France, in total length 27, snout to abdominal pores 15, snout to first dorsal $8\frac{1}{2}$, snout to pectoral $5\frac{3}{8}$, snout to mouth $2\frac{1}{2}$, and caudal $5\frac{1}{2}$ inches.

Figured from the New England Coast, Plate **14**, fig. 1–4.

Squalus sucklii.

Acanthias vulgaris Schlegel, 1850, Jap. Pisces, p. 304, pl. 135 (non Risso).
Spinax (Acanthias) sucklii Girard, 1854, Proc. Acad. nat. sci. Phil., p. 196.
Acanthias sucklii Girard, 1858, Rept. Pacif. R. R. Fish., p. 368.
Squalus sucklii Gill, 1862, Proc. Acad. nat. sci. Phil., p. 499; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 54.
Squalus mitsukurii Jord. & Snyder, 1901, Check list, p. 129; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 629, f. 3; Gilbert, 1905, Bull. U. S. fish. comm., **23**, p. 580; Regan, 1908, Ann. & mag. nat. hist., ser. 8, **2**, p. 47.
Squalus japonicus Ishikawa, 1908, Proc. Acad. nat. sci. Phil., **60**, p. 71.
Acanthias mitsukurii Günther, 1910, Südsee fische, **3**, p. 490.

Snout little broader than that of *S. acanthias*, blunted at the end; nostrils transverse, midway from the mouth to the end, anterior valve short, with outer angle produced and an indentation or notch in the middle of the hind edge in which there is a rudimentary median process. Eye moderate, orbital length nearly half the distance from the end of the snout, to which it is nearer than to the gill opening. Spiracle a little nearer to the end of the snout than to the pectoral. Mouth with a deep groove and labial folds at each angle, width about two thirds of the preoral length. Gill openings little more than half the length of the orbit, hindmost widest, in front of the pectoral. Pectoral broader than long, angles rounded, hind edge slightly concave, fin applied to the side reaching below the first dorsal spine. Spine of first dorsal very little if any farther back than the inner extremity of the pectoral, rather small, about half the length of the front margin of the fin; base without the spine less than one fourth of its distance from the second dorsal, hind edge concave, hind angle produced. Base of the second dorsal less than two thirds as long as that of the first, less than half of the distance from the caudal, hind margin deeply concave, hind angle produced but not reaching half way to the caudal. Origin of the ventrals little nearer to the caudal than to the origin of the pectoral, nearer to that of the second dorsal than to that of the first dorsal. Dermal folds at the side of the tail fainter below the second dorsal than farther back. Caudal with a pit in front and with a well developed subcaudal lobe. Total length of specimen described 24, snout to abdominal pores $10\frac{1}{4}$, snout to dorsal 8, snout to pectoral 5, snout to second dorsal $14\frac{1}{4}$, snout to ventral $12\frac{1}{4}$, and caudal 5 inches.

Back brown, dark to reddish with or without small spots of white in two rows on the upper part of each flank, placed somewhat as those of *S. acanthias*, sometimes very few or entirely absent; lower surfaces white. Young with lighter margins on the fins.

Apparently there are two varieties of this species; one of them from the North Eastern Pacific, *S. sucklii*, the other *S. mitsukurii*, from the North Western or Japanese Pacific.

Squalus fernandinus.

Mustelus spinax Belon, 1553, Aquat., p. 69; Salviani, 1554, Aquat., f. 136, pl. 43; Willughby, 1686, Pisc., p. 56, pl. B 5, f. 1.

Galeus acanthias Aldrovandi, 1613, Pisc. & Cet., p. 399.

Squalus fernandinus Molina, 1782, Saggio sulla storia nat. Chili; Bonnaterre, 1788, Ichth., p. 13; Gmelin, 1789, Linné Syst., **1**, p. 1501; Molina, 1789, Essai l'hist. nat. Chili, p. 208; 1808, Geogr. nat. & civ. hist. Chili., **1**, p. 160; 1810, Saggio sulla storia nat. Chili, ed. 2, p. 194; Waite, 1909, Rec. Canterb. mus., **1**, no. 2, p. 12.

Squalus acanthias var. *fernandinus* Walbaum, 1792, Artedi, p. 505; Donndorff, 1798, Zool. beytr., **3**, p. 855.

Acanthorhinus ferdinandinus Blainv., 1816, Bull. Soc. philom., p. 121.

Acanthias blainvillii Risso, 1826, Hist. nat., **3**, Poissons, p. 133, pl. 3, f. 6; Müller & Henle, 1841, Plagios, p. 84; Duméril, 1865, Elasm., p. 438; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 419; Moreau, 1881, Poiss. France, **1**, p. 345; Doderlein, 1881, Man. ittiol. Med., **2**, p. 90; Macleay, 1881, Proc. Linn. soc. N. S. W., **6**, p. 367.

Spinax blainvillii Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 57, f. 1; Agass., 1843, Rech. poiss. foss., **3**, p. 61, pl. B, f. 1.

Spinax fernandezianus Gay, 1854, Hist. Chile, **2**, p. 365; Perez, 1886, Estud., p. 10.

Acanthias megalops Macleay, 1881, Proc. Linn. soc. N. S. W., **6**, p. 367; Ogilby, 1888, Proc. Linn. soc. N. S. W., ser. 2, **3**, p. 1096; 1889, ibid., **4**, p. 185.

Acanthias fernandezianus Philippi, 1887, Ann. Univ. Chile, **71**, p. 559; extr., p. 27, pl. 4, f. 3.

Squalus fernandezianus Delfin, 1901, Cat. peces Chile, p 21.

Squalus megalops Waite, 1901, Rec. Austr. mus., **4**, p. 33, pl. 4, f. 2; 1904, Mem. N. S. Wales nat. club, no. 2, p. 8; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 47.

Squalus blainvillii Ribeiro, 1907, Arch. Mus. nac., **14**, p. 168; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 47.

Squalus acutipinnis Regan, 1908, Ann. Natal mus., **2**, p. 248, pl. 37.

Squalus philippinus Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 677, fig., pl. 51.

Head broad, depressed, tapering, less than one fourth of the total length. Snout less than half the head, blunt; nostrils little nearer to the end than to the mouth, anterior valve broadly rounded on the outer angle and with a short angular median process on the hind margin. Length of orbit about equal the width of the internarial space, little less than the length of the snout from the nostrils, little more than half the width of the mouth, hind corner about half way from the end of the snout to the second gill opening. Width of mouth little more than two thirds of the preoral length, each angle with a deep groove and with labial folds. Cutting edges of the teeth nearly parallel with the edges of the jaws, upper teeth narrower. Spiracles about equidistant from the end

of the snout and the pectorals. Gill openings in front of the pectorals, width about half the length of the orbit. Pectorals large, width less than length of front margin, broader than long, outer angle rounded, hind margin concave, inner angle somewhat narrowly rounded, fin applied to the flank subtending the entire base of the first dorsal. Origin of the first dorsal above the axils of the pectorals and spine above the middle of their inner free margin, middle of the base above the inner angle of the pectoral, hind margin nearly straight, upper angle rounded, hinder produced; spine strong, without grooves on the sides, nearly two thirds as high as the fin; base of fin without the spine two thirds of the height, nearly two fifths of the distance from the origins of the ventrals, nearly one fifth of its distance from the second dorsal, or less than half the distance from the last to the caudal. Base of second dorsal two thirds as long as that of the first, more than one third of the distance from the caudal; spine strong, nearly as high as the fin, inserted one length of the base without the spine behind the ends of the ventrals, and nearly one length of the space between the base of the second dorsal and the caudal behind the axils of the ventrals. Origins of the ventrals much nearer those of the pectorals than to the origin of the caudal, midway from that of the first dorsal to that of the second. Caudal as long as the head, with a pit in front, subcaudal lobe produced, without a notch between subcaudal and terminal, latter pointed with convex edges and blunted end. Scales small, with a strong peduncle and a crown with three keels produced in sharp cusps the median of which is longest. A fold at each side of the tail behind the second dorsal. Total length of a specimen from Juan Fernandez 36, snout to abdominal pores 19, snout to first dorsal $10\frac{1}{2}$, snout to pectorals 8, snout to mouth $3\frac{3}{8}$, and caudal 8 inches.

Back brown; whitish below; hind edges of lower fins and caudal lighter.

Centrophorus.

Squalus Rafinesque, 1810, Caratteri, p. 13.
Centrophorus Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 115; 1837, Wiegm. archiv, p. 398; 1841, Plagios, p. 89.
Entoxychirus Gill, 1862, Proc. Acad. nat. sci. Phil., p. 498.

Body fusiform, head depressed, snout blunt. Nostrils slightly oblique. Eyes large, without a nictitating membrane; orbits long, with an angle at each end. Mouth wide, little arched, with a deep groove and labial folds at each angle. Teeth compressed, unlike in the two jaws; upper with triangular cusp, more erect; lower with the inner or cutting edge directed outward. Spiracles

rather large directed upward. Gill openings moderate, in front of the pectoral. Pectorals medium, inner angle produced. Two dorsals, each with a spine longitudinally grooved on each side and exposed at the top; first dorsal near the pectorals, second behind the ventrals. Tail without caudal pits; subcaudal fin separated by a notch from the terminal. Scales small, carinate or striate.

C. primaevus Pictet is from the Upper Cretaceous.

Teeth not serrate

lateral upper teeth somewhat similar to lower

without the spines the base of the second dorsal is $\frac{3}{4}$ of that of the first and the fin is larger than the ventrals . . *uyatus* (page 197)

lateral upper teeth unlike the lower

without the spines the base of the second dorsal equals $\frac{1}{2}$ of that of the first . . . . . *lusitanicus* (page 199)

second dorsal base nearly equal that of the first and the fin is much larger than the ventrals . . . . . *acus* (page 199)

second dorsal smaller than the ventrals and both are smaller than the first dorsal . . . . . *atromarginatus* (page 200)

a large spot of black on the first dorsal . *moluccensis* (page 201)

Teeth serrate

cusps serrated on the lower jaws . . . *granulosus* (page 201)

cusps serrated on both jaws on the basal portions only *tessellatus* (page 202)

Centrophorus uyatus.

Squalus uyato Rafinesque, 1810, Caratteri, p. 13, pl. 14, f. 2.
Squalus uyatus Rafinesque, 1810, Indice, p. 45; ? Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 48.
Squalus (Acanthorhinus) infernus Blainv., 1830, Poiss. Fr., p. 59.
Acanthias uyatus Müller & Henle, 1841, Plagios., p. 85; Duméril, 1865, Elasm., p. 439; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 419; Canestrini, 1872, Ital. pesci, p. 40; Moreau, 1881, Poiss. France, **1**, p. 346; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 92.
Spinax uyatus Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 57, f. 2 without the teeth.
Entoxychirus uyatus Gill, 1862, Proc. Acad. nat. sci. Phil., p. 498.
Centrophorus uyatus Garman, 1906, Bull. M. C. Z., **46**, p. 204.
Centrophorus bragancae Regan, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 438; 1908, ibid., ser. 8, **2**, p. 53.

Subfusiform, moderately elongate. Head depressed. Snout broad, broadly rounded in front; nostrils in the anterior two fifths, their distance apart nearly equal to their distance from the end; nasal valve with a rounded lobe near the outer edge. Mouth wide, width little more than the distance from the nostrils, slightly curved, with a deep groove and short labial folds at each angle, upper fold little longer. Teeth sectorial, compressed, diverse, intermediate between those of *Squalus acanthias* and those of *Centrophorus granulosus*, in $\frac{37}{32}$

rows: symphyseal upper teeth triangular, erect, from these the lateral become more oblique and at the sides of the mouth resemble somewhat those of *Squalus acanthias*, the cutting edge approaching the horizontal; on the lower jaws the teeth are like those of *S. acanthias*, the cutting edges are smoother and more nearly horizontal than those of *C. granulosus*. Eye large, length of orbit equal the preorbital length of the snout, or three fourths of the distance to the first gill opening. Spiracle rather large, crescentic, situated less than its diameter behind the corner of the eye and as much above it. Gill openings wide, widening and becoming closer together backward, hindmost one abruptly widest, hindmost pair close together, in front of the pectoral. Pectorals large, outer angle rounded and below the spine of the dorsal, inner angle much produced, but hardly subtending the dorsal base. Dorsal spines strong, grooved longitudinally on the sides, not as high as the fins, anterior exposed about one third and posterior more than half of the length. Origin of the first dorsal above the axils of the pectorals, end of base very little behind the ends of the pectorals, base excluding the spine equal two sevenths of the interdorsal space. Second dorsal about two thirds as large as the first, origin behind the axils of the ventrals, hind angle produced and reaching behind the origin of the subcaudal. Ventrals small, outer angle broadly rounded, hinder sharp, end below spine of the second dorsal. Caudal little more than one fourth of the total length, rather deep; subcaudal without a produced lobe, separated from the terminal by a shallow notch. Scales small, rough, with a strong median and weaker lateral converging keels; on the snout the scales are more sessile and when the crowns have worn away the edges indicate a greater number of ridges; near the dorsal fins they resemble those of Oxyrhina.

Rusty brown, back little darker, lower surfaces whitish; in young the edges of the caudal and the paired fins are lighter; inside of mouth dark.

Total length of an immature male, from Nice, 20, snout to abdominal pores $11\frac{1}{2}$, snout to dorsal 6, snout to pectoral $4\frac{1}{2}$, snout to mouth 2, and caudal $5\frac{1}{4}$ inches.

The outlines of the figure given by Bonaparte are excellent; the teeth figured with it are those of a Squalus.

This species is very distinct from others of the genus, but is a true Centrophorus, and cannot be placed in Squalus, as has been recently suggested by Regan (Ann. mag. nat. hist., ser. 8, **2**, p. 48), and previously by other authorities.

Centrophorus lusitanicus.

Centrophorus lusitanicus Bocage & Capello, 1864, Mem. Acad. roy. sci. Lisboa, **3**, p. 1, ex.; Proc. Zool. soc. London, p. 260, f. 1; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 421; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 12; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 53.
Centrophorus granulosus var. *lusitanicus* Bocage & Capello, 1866, Plagios., 23, pl. 1, f. 3.

In this species the dorsal spines are shorter and less exposed than in *C. granulosus*, the first dorsal has a longer base and its hinder angle is more produced, the pectorals are shorter and their inner angles are less produced, the teeth are smoother on the edges and the scales are less rough. Nostrils separated by more than one third of the length of the snout. Labial folds short. Teeth not serrate, upper slightly and lower moderately oblique. Inner angle of pectorals somewhat produced but not so much as in *C. granulosus*. Without the spines, the base of the second dorsal is half as long as that of the first, or one fourth as long as the interdorsal space. Ends of the ventrals below the hind part of the second dorsal. Dorsal spines short, exposure about one third of the length. Scales small, sessile, finely striate.

Brownish.

Off the coasts of Portugal in deep waters.

Centrophorus acus.

Plate **12**, fig. 5–8.

Centrophorus acus Garman, 1906, Bull. M. C. Z., **46**, p. 204; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 53.

Elongate; head less than one fourth of the total length; snout long, depressed, length equal that of base of first dorsal without the spine, broadly rounded at the end. Nostrils distant from one another as far as from end of snout, valves with a sharp pointed lobe. Eye large, half as long as the snout, hinder third of its length above the mouth. Mouth large, width four fifths of the length of the snout, slightly curved, with a deep straight groove and short labial folds at each angle. Teeth $\frac{36}{34}$; upper with triangular sharp cusps, erect in the median and becoming oblique in the lateral; lower with cusps little broader, from the symphysis outward directed obliquely toward the angles of the mouth. Spiracle moderate, semilunate, width equal three fourths of its distance from the eye, or one third of the length of the orbit. Gill clefts large, hindmost widest and nearly equal to the distance between the nostrils, foremost two thirds the width of the hindmost, in front of the pectorals. Width of

pectorals nearly half of the length, outer angle broadly rounded, inner angle much produced, end reaching below the dorsal spine. Dorsal spines moderate, anterior exposed one third and posterior two fifths of the height. First dorsal entirely in the forward half of the total length, origin behind the bases of the pectorals above their outer angles, height about half the length of the base including the spine. Second dorsal larger than the ventrals, as high as the first dorsal, base one fourth shorter than the first, hinder angle acute reaching over more than two thirds of the distance from the base to the caudal. Caudal deep, length less than one fourth of the total, depth less than half of the length, subcaudal lobe of moderate size, a notch at end of subcaudal. Scales rough, each with a strong median and two weaker lateral cusps on the hinder edge extended from keels on the crown. On the white scales scattered over the body the keels appear to be more numerous and to vanish before reaching the hinder part of the scale.

Dark greyish brown, light below, lighter in an area behind the orbit and another in the middle of the forehead.

Total length of the type $32\frac{1}{4}$, snout to vent 20, snout to dorsal $11\frac{1}{2}$, snout to pectorals 7, snout to mouth 3, and length of caudal $7\frac{1}{2}$ inches.

Japan. Alan Owston.

Centrophorus atromarginatus, sp. nov.

Plate **13**, fig. 1–4.

Body subfusiform, slightly compressed, moderately robust. Head long, depressed, broad; snout narrowing rapidly in front of the eyes, blunt on the end, flattened beneath, little longer than the base of the dorsal including its spine. Distance of nostrils from one another equal their distance from the end of the snout, or three fifths of that from the mouth; valve with a rounded lobe at the base of which is a lobule. Eye large, length of orbit equal the preorbital length, hind corner above angle of mouth. Mouth little curved, with a long straight groove and labial folds at each angle; width nearly two thirds of the preoral length. Teeth compressed, in $\frac{42}{30}$ rows; in eight or ten of the longitudinal rows on the upper jaw they are a trifle smaller and nearly erect, from these they become more oblique; on the lower jaws the teeth are larger and the cutting edges are more nearly horizontal. Spiracle large, semilunate, above and backward about one diameter from the corners of the eyes. Gill openings moderate, foremost about one third the length of the orbit, hindmost much wider, in front

of the pectoral. Dorsal spines strong, much exposed, subtriangular in cross section, with grooved sides. First dorsal entirely in the forward half of the total length, base without the spine equal the height, origin above the outer angle of the pectoral, hinder angle much produced. Spine of second dorsal above the middle of the free portions of the ventrals, fin three fourths as high as that of the first dorsal, hind angle long pointed, end less than half the length of the base from the caudal. Caudal with well developed lower lobe, a slight notch separating the subcaudal from the terminal. Pectorals wide, outer angle rounded, hinder produced in a slender extremity reaching beyond the middle of the dorsal base. Scales with keels or striae converging toward the apex, smooth and pavement-like on the body, where worn. Total length $33\frac{3}{4}$, snout to tail $20\frac{3}{4}$, snout to dorsal $11\frac{1}{8}$, snout to pectorals $7\frac{1}{2}$, snout to mouth $3\frac{1}{8}$, and caudal $8\frac{1}{2}$ inches.

Upper surfaces greyish brown, thickly sprinkled with scales of white; whitish below; edges of pectorals, dorsals, and caudal blackish.

Suruga Gulf, Japan. Alan Owston.

Centrophorus moluccensis.

Centrophorus moluccensis Bleeker, 1860, Act. Soc. sci. Ind. Neerl., **8**, p. 3 extra; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 54.
Centrophorus granulosus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 420 (part).

Spiracles superior; nostrils about one third of the distance from the end of the snout to the angles of the mouth; eyes large, length of orbit two sevenths of that of the head, nearly equal the distance from the end of the snout; mouth slightly curved; body unspotted; anterior dorsal with a large spot of black; ventrals inserted in advance of the second dorsal. Original description from a foetus of about 8.6 inches, from Amboina.

Centrophorus granulosus.

Squalus granulosus Schneider, 1801, Bloch Ichth., p. 135.
Acanthorhinus granulosus Blainv., 1816, Bull. Soc. philom., p. 121.
Centrophorus granulosus Müller & Henle, 1841, Plagios., p. 89, pl. 33; Guichenot, 1850, Expl. Alg., p. 126; Gray, 1851, Chondropterygii, p. 74; Bocage & Capello, 1864, Proc. Zool. soc. London, p. 261, f. 1; 1866, Plagios, p. 25, pl. 1, f. 3, pl. 3, f. 1; Capello, 1870, Jor. Acad. sci. Lisboa, **2**, p. 143; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 420; Moreau, 1881, Poiss. France, **1**, p. 352; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 12, pl. 3, f. 11; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 53.

Body fusiform, elongate. Head depressed. Snout tapering, blunted at the end, length from the orbit greater than distance from orbit to gill opening.

Nostrils in the anterior two fifths of the snout from the mouth, their distance apart equals little more than their distance from the end of the snout; valve with a sharp process in the middle. Eye large, length of orbit greater than that of the snout in front of it. Mouth large moderately curved, with a deep groove and labial folds at each angle; upper fold nearly half the length of the jaw. Teeth compressed, triangular, sectorial; upper nearly erect in front, more oblique at the sides; lower oblique, little wider than the upper, with fine serrations on the edges. Width of gill openings less than length of orbit, upper ends in front of the pectorals. Pectorals longer than wide, inner angle much produced, reaching behind the dorsal spine. Origin of first dorsal behind the axil of the pectorals, fin entirely included in the forward half of the total length; base, not including the spine, one third of the interdorsal space. Base of second dorsal three fourths as long as that of the first, hind angle reaching a vertical from the origin of the subcaudal. Dorsal spines strong, nearly half exposed, anterior the shorter and not as high as the fin. Bases of ventrals wholly in front of the base of the second dorsal, the short claspers reach below the spine of that fin. Scales small, sessile, rising to a point with convergent keels or striae, smoother with wear in age. Caudal less than one fourth of the total length, rather deep, with a weak subcaudal lobe, terminal fin preceded by a shallow indentation behind the subcaudal.

Light brownish to greyish brown.

Mediterranean and adjacent Atlantic.

Centrophorus tessellatus.

Centrophorus tessellatus Garman, 1906, Bull. M. C. Z., **46**, p. 205; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 54.

Body subfusiform, robust. Head including the gill openings about one fourth of the total, depressed, flattened below and on the crown, sides steep. Snout long, broad and bluntly rounded at the end. Nostrils nearly transverse, their distance apart equal their distance from the end of the snout, or less than two thirds of that from the mouth; valve with an oblique angular lobe which bears on its inner side a lobule. Eye large, less than half the length of the snout from the mouth, hind extremity of orbit above the mouth. Width of mouth three fifths of the length of the snout, little curved, a long deep straight groove with labial folds extending one third the length of each jaw, at each angle. Teeth compressed, serrated on the basal portions of each cusp, in $\frac{42}{31}$ rows; upper erect in the middle of the mouth, becoming oblique toward the angles, each tooth

with a slender pointed broader based cusp; lower teeth broader, oblique, with the inner or cutting edge convex and serrated, ending in a sharp smooth-edged cusp at its outward extremity. Spiracles moderate, semilunate, distant one and a half times their diameter from the orbit. Gill openings small, first about one third the length of the orbit, hindmost nearly twice as wide as the first, much wider than the fourth, in front of the pectoral. First dorsal reaching little behind the middle of the total length; spine little backward from the outer angle of the pectoral; base including the spine equal four fifths of the length of the outer edge of the pectoral, or two fifths of the distance from the base of the first dorsal to the spine of the second; exposed portion of the spine short; upper angle of fin rounded, hind angle produced, acute. Second dorsal as high and four fifths as long as the first, similar in shape, length of base three fifths of the distance from the caudal, spine one third exposed. Pectorals wide with a very long acuminate inner angle, otherwise the hind margin is slightly concave. One of the pectorals on the specimen described appears abnormal in that it is subtruncate on the hind margin and lacks the acute angled extremity, which on the normal fin reaches behind the spine of the first dorsal. Ventrals reaching below the spine of the second dorsal, concave on the hind margin, acute in the ends; claspers short, ends slender and pointed with a short slender spine a little distance from the end on the outer side. Caudal with a well developed subcaudal lobe. Scales somewhat rough, with five to nine converging keels or striae on those of the head and shoulders; farther back the apices are smooth, from wear, and the remains of the striae surround the base. Total length $34\frac{1}{2}$, body $22\frac{1}{2}$, snout to dorsal 13, snout to pectoral 8, snout to mouth 4, and caudal fins 7 inches.

Back and flanks brownish, lower surfaces white, a white border on the fins and the gill covers.

Lat. 35° N.; Lon. 139° 30′ E., in 400 fathoms. Alan Owston.

Centroscymnus.

Centroscymnus Bocage & Capello, 1864, Diag. fam. Squal., p. 3 extra; Proc. Zoöl. soc. London, p. 263; 1866, Plagios., p. 29.

Body subfusiform, slightly compressed. Nostrils oblique, distinct from the mouth cavity. Eye large, without nictitating folds. Mouth transverse, slightly curved, with a deep groove and with labial folds at each angle. Teeth dissimilar; upper raptorial, small, lanceolate, in three groups, the middle one of which is outside (in front) of the lower jaws; lower teeth sectorial, broad, with

oblique triangular cusps. Spiracles moderate, with a large prespiracular cavity extending forward to the orbit. Dorsals small, spines hardly visible, or hidden. No anal fin. Caudal rather short and deep, with a subcaudal lobe. Pectorals small, inner angle not produced. Scales of the body pedicellate, with crown depressed and smooth above the pedicel, edges striate to carinate; scales of the head sessile, carinate.

Snout from the mouth shorter than the distance from eye to first gill opening
  first dorsal little the smaller; end of spines exposed
    scales of head striate . . . . . *coelolepis* (page 204)
Snout from mouth longer than the distance from eye to first gill opening
  first dorsal much the smaller; end of spines exposed
    scales of head with 3–5 keels or striae . . *owstonii* (page 205)
  first dorsal the shorter; spines hidden
    scales of head with three parallel keels . *cryptacanthus* (page 206)

Centroscymnus coelolepis.

Plate **14**, fig. 5–8.

Centroscymnus coelolepis Bocage & Capello, 1864, Diag. fam. Squal., p. 3; Proc. Zool. soc. London, p. 263, f. 4; 1866, Plagios., p. 30, pl. 2, f. 3; Wright, 1868, Ann. mag. nat. hist., ser. 4, **2**, p. 426; Vaillant, 1888, Travailleur et Talisman, Poissons, p. 63, pl. 2, f. 1; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 14, pl. 4, f. 13; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 49; Jord. & Everm., 1900, Bull. 47, U. S. nat. mus., pl. 8, f. 25 (non description).

Body robust, subfusiform, body cavity little more than two thirds of the total length. Snout short, depressed, broadly rounded at the end. Nostrils oblique, nearer to the end of the snout than to the mouth. Mouth wide, width greater than length of snout, with a deep groove and with labial folds at each angle; lower fold not half as long as the jaw. Teeth in $\frac{70}{42}$ rows; upper lanceolate, four or five series in function; lower broad, compressed, with cutting edge directed obliquely toward the angles of the mouth, one series in function, except when about to be dropped. The teeth on the upper jaws are much more numerous than those of the lower, and are in three groups, that is a lower front group of 24 to 26 rows nearer the symphysis resting in front (outside) of the lower jaws and occupying a more prominent position, and a lateral group near each corner of the mouth of smaller teeth and resting inside of (between) the lower jaws. Eyes large, orbit elongate, more than half the length of the snout, with a slight angle in front and an angular fold in the skin behind. Spiracles half as long as the orbit, opening upward. Gill openings narrow, not as wide as the orbit, equally spaced, in front of the pectoral. Pectorals medium, not reaching a

vertical from the origin of the dorsal. Dorsal spines small, hardly projecting; fins small, the first in the anterior half of the total length, the second quite as large as the first, more pointed, and situated near the forward end of the posterior third of the total, twice as long as wide, origin above or slightly behind the middle of the ventrals bases. Ventrals larger than the second dorsal, extremities not reaching as far backward. Subcaudal separated from the terminal portion of the caudal by a notch, lobe moderately produced. Scales pedicellate; those of the flanks larger, smooth and somewhat concave on the top near the forward edge, smaller with feeble striae on head and neck, very small toward the edges of the fins, axils of fins naked.

Deep chestnut-brown above and below, lighter near the centre of the larger scales, little darker on snout and fins.

Described from a female specimen of forty-four inches taken off the coast of New England.

Originally known from deep waters off Portugal.

Centroscymnus owstonii.

Plate 13, fig. 5–8.

Centroscymnus owstonii Garman, 1906, Bull. M. C. Z., **46**, p. 207; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 49.

Body subfusiform, moderately robust, slightly compressed; head depressed; snout broad and broadly rounded on the end. Nostrils oblique, small, two thirds as far from the end of the snout as from one another, valve broad. Eye large, little more than half the preoral length. Mouth moderately curved, width two thirds of the preoral length, with a deep groove at each angle; labial folds short, upper longer, hidden by the groove. Teeth in $\frac{72}{36}$ rows; upper narrow, lanceolate, in three groups separated by smaller teeth; median group widest and most prominent, functioning outside (in front) of the lower jaws, lateral groups narrower, functioning inside (between) the lower jaws; lower teeth broad, compressed, a single series in function, except when about to be shed, cusps obliquely directed outward. Spiracles medium, backward and above from the eye, externally separated from the orbit by twice their width, but internally with a large prespiracular chamber or cavity below the skin extending forward to a point above the hinder portion. Gill openings small, width one third of the orbital length, in front of the pectoral. Pectorals twice as long as wide, inner angle not developed, fin not reaching a vertical from the dorsal spine by about one length of the orbit. Dorsal spines very little exserted, weak. First dorsal wholly in

the anterior half of the total length; fin narrow, free portion as long as the base, upper angle rounded, hinder not produced. Length of second dorsal equal that of the first; height greater in second and hind angle produced; origin above or little behind the middle of the bases of the ventrals. Base of ventrals equal to its distance from the caudal, outer angle very blunt, rounded, posterior acuminate, not extending as far back as the end of the second dorsal; axils below the spine of the latter. Caudal short and deep, a well developed subcaudal lobe, a notch in front of the terminal fin. Claspers of male extending little beyond the end of the fin, ending in a slender point at the upper side of which is a long sharp spine. Scales similar to those of *C. coelolepis;* those on the flanks and back are comparatively smooth and there is a rounded depression above the pedicel; on those over the head, shoulder and belly there are 3–5 weak keels.

Dark brown, slightly mottled and clouded.

Japan.

Centroscymnus cryptacanthus.

Centrophorus (Centroscymnus) coelolepis Günth., 1870, Cat. fishes Brit. mus., **8**, p. 423.
Centroscymnus coelolepis Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., 17; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 55, (not fig.).
Centroscymnus cryptacanthus Regan, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 437.

Length of snout from mouth greater than the distance between eye and first gill opening. Length of anterior labial fold about equal to its distance from the symphysis. Upper teeth small, narrow, lanceolate. Internarial distance less than half the preoral length of the snout. Pectoral not extending to a vertical from the first dorsal, hinder angle rounded. First dorsal shorter than second, base about half the height, or one sixth of the interdorsal space. Base of second dorsal, without the spine, three fourths of its distance from the caudal. Dorsal spines short, hidden beneath the skin. Ventrals reaching a vertical from the end of the second dorsal fin. Scales smooth with a depression at the base, except those on the head and upper and lower parts of the body to the first dorsal each of which has three parallel keels, produced behind the edge.

Uniform dark brown.

Type a male of about $27\frac{1}{2}$ inches, from Madeira.

Centroselachus, gen. nov.

Body elongate, head and tail short. Snout intermediate between that of Acanthidium and that of Centrophorous, produced moderately, depressed, broad. Nostrils oblique. Mouth transverse, with grooves and labial folds. Upper

teeth erect, small, short, with triangular cusps, in three groups; lower teeth broader, oblique, not serrate. Spiracles large. Fins rather small, angles hardly produced. Dorsal spines slightly exposed, anterior spine near the pectorals, posterior near the caudal. Scales uniform, with slender vertical peduncle and broad, rounded, pluricarinate crown.

Centroselachus crepidater.

Centrophorus crepidater Bocage & Capello, 1864, Diag. fam. Squal., p. 3; Proc. Zool. soc. London, p. 262, f. 3; 1866, Plagios., p. 27, pl. 2, f. 2; Capello, 1870, Jor. Acad. sci. Lisboa, **2**, p. 144; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 421; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 13.
Centroscymnus crepidater Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 50.

Body moderately elongate, subround, cavity long, tail short. Snout broad, depressed; nostrils oblique, nearer to the end than to the mouth. Mouth wide, arched forward, with deep grooves at the angles; labial folds produced forward toward the middle. Teeth unlike, not serrate: upper small, narrow, short, triangular, nearly erect, in a median and two lateral groups; lower broader, compressed, oblique. Spiracles large, behind the eye. Gill openings narrow, in front of the pectoral. All fins small; dorsals nearly equal, spines with short apex exposed, spine of the first about midway from that of the second dorsal to the end of the snout, spine of the second much nearer to the extremity of the caudal than to the base of the first dorsal. Pectorals short, rounded, reaching nearly to a vertical from the origin of the dorsal. Origin of second dorsal above middle of bases of ventrals. Ends of ventrals below end of base of second dorsal. Caudal short, with feeble subcaudal lobe, and a shallow notch between the subcaudal and the terminal portions. Scales rather large, peduncle slender, erect, below the middle of the flattish, rounded crown which is roughened by five to seven divergent keels. Adult at less than three feet in length.

Dark rusty brown.

From deep waters off the coasts of Portugal.

Scymnodon.

Scymnodon Bocage & Capello, 1864, Diag. fam. Squal., p. 3; Proc. Zool. soc. London, p. 263.
Zameus Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 632.

Body slightly triangular in a cross section. Head flattened on the crown, wide posteriorly. Nostrils below the snout, far forward, oblique. Spiracles large, behind the eyes and at a somewhat higher level. Mouth large, arched forward, with a deep straight groove at each angle and with labial folds.

Teeth unlike in the two jaws: upper awl-shaped, raptorial; lower compressed, smooth on the edges, sectorial, more or less oblique. Two small dorsal fins, with the spine shortly exposed. Caudal well developed, vertebral axis raised backward, subcaudal lobe rather weak.

Spine of first dorsal more than halfway from end of snout to caudal, not reached by the pectoral
cusps of lower teeth nearly erect.
dorsal spines slightly projecting
base of first dorsal, without spine, $\frac{1}{4}$ of interdorsal space
ringens (page 208)

Spine of first dorsal about halfway from end of snout to caudal, not reached by the pectoral
base of first dorsal less than $\frac{1}{6}$ of interdorsal space
squamulosus (page 209)

Spine of first dorsal less than halfway from end of snout to caudal.
cusps of lower teeth oblique
dorsal spines somewhat projecting, nearly reached by the pectorals
base of first dorsal more than $\frac{1}{5}$ of interdorsal space
plunketi (page 210)
dorsal spines strongly projecting, first dorsal reached by pectorals
base of first dorsal $\frac{2}{5}$ of interdorsal space *macracanthus* (page 210)

Scymnodon ringens.

Scymnodon rigens Bocage & Capello, 1864, Diag. fam. Squal., p. 3 extra.
Scymnodon ringens Bocage & Capello, 1864, Proc. Zool. soc. London, p. 263, f. 5; 1866, Plagios., p. 32, pl. 1, f. 1; Capello, 1870, Jor. Acad. sci. Lisboa, **2**, p. 145; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 48.
Centrophorus ringens Günth., 1870, Cat. fishes Brit. mus., **8**, p. 423; Sim, 1902, Ann. Scott. nat. hist., **11**, p. 13.
Centroscymnus obscurus Vaillant, 1888, Travailleur et Talisman, Poissons, p. 67, pl. 2, f. 2.

Snout large, short, subconic, length from the end to the eye about half of that from the same point to the spiracle, perhaps a little less; mouth wide, with a deep groove at each angle, and with labial folds; nostrils oblique, at the end of the anterior third of the preoral length. Upper teeth raptorial, subulate; lower compressed, sectorial, with a quadrangular base on which is a triangular, smooth-edged, more or less oblique cusp. Spiracle large, nearly parallel with the upper surface of the head. Pectorals medium, oblong, rounded. Dorsal spines exposed at the point, that of the first dorsal about midway from the origins of

the pectorals to those of the ventrals. First dorsal narrow; second twice as wide, origin above the hind extremities of the bases of the ventrals. Caudal short and deep. Scales small tricarinate with short pedicel.

Reaches a length of about four feet.

Uniform brown to blackish.

Taken off the coasts of Portugal in deep water, and off the coast of Soudan, at a depth of 1,400 metres.

Scymnodon squamulosus.

Centrophorus squamulosus Günth., 1877, Ann. mag. nat. hist., ser. **4**, **20**, p. 433; 1887, Challenger rept. Zool., **22**, p. 5, pl. 2, f. B.
Zameus squamulosus Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 633.
Scymnodon squamulosus Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 48.

Head depressed; snout bluntly rounded, length about equal the distance from the angles of the mouth to the first gill opening. Nostrils oblique, at the end of the anterior third of the preoral length, with a small sharp process in the middle of the anterior valve. Mouth slightly arched, width less than the length of the snout, with a deep straight groove at each angle, and short labial folds of which the upper is longest, besides a fringed upper lip. Teeth smooth on the edges; upper more slender, nearly erect; lower broader, with a triangular cusp on a subquadrangular base, nearly erect at the symphysis, oblique toward the angles. Spiracles little above the level of the eye and about one length of the orbit farther back. Gill openings small, upper ends in front of the pectoral. Pectorals small, inner angle blunt and not produced. Dorsal spines hardly produced beyond the skin. Base of first dorsal in the middle of the distance from the end of the snout to the caudal fin, length less than one fifth of the interdorsal space, fin narrow. Second dorsal much larger than the first, origin above the hind parts of the bases of the ventrals, length of base less than the distance from the caudal, hind angle acutely produced. Ventrals about equal to the second dorsal, ends of the fins below the hinder part of the base of the latter. Caudal short, in length about twice the greatest depth, terminal portion rounded, subcaudal separated from the terminal by a shallow notch, lobe weak, broadly rounded. Scales minute, tricarinate.

Uniform black.

Type an adult female of twenty-seven inches taken off Enoshima, Japan, in 345 fathoms, by the Challenger Expedition.

Scymnodon plunketi.

Centrophorus plunketi Waite, 1910, Trans. N. Z. inst., **42**, p. 384, pl. 37.

Head broad, depressed. Snout short, blunt; nostrils near the end, nearer to the tip than to the eye, oblique. Mouth nearer to the end of the snout than to the first gill opening, width half the length of the head, a deep groove and labial folds at each angle, lower fold shorter. Upper teeth small, lanceolate, two-rooted; lower, of 30 teeth, with cusp directed obliquely toward the angle. Spiracle large, a little nearer to the eye than to the gill opening. Gill openings half the diameter of the eye, in front of the pectorals. Dorsal spines not half the height of the fins, with short exposure; first midway from the front of the eye to the base of the second dorsal, length of base without the spine slightly more than one fifth of the interdorsal space. Second dorsal much larger, base and spine equal distance from base to caudal, spine above the bases of the ventrals. Pectoral large, length equal to distance from tip of snout to first gill opening, inner angle rounded, fin not reaching below the first dorsal. One third of the bases of the ventrals lies behind the spine of the second dorsal. Scales small, tricarinate, tricuspid, median keel and cusp longer.

Uniform dark brown.

Known from the description of the type, a female of near 4 ft. 8 inches (1,414 mm.) taken off Riley's Islands, New Zealand in a depth of 120 fathoms.

Scymnodon macracanthus.

Centroscymnus macracanthus Regan, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 436.

Snout from mouth equal to distance from eye to first gill opening. Nostrils very oblique. Anterior labial fold about equal to its distance from the symphysis. First dorsal shorter than second, base without spine equal two thirds of the height and two ninths of the interdorsal space. Base of second dorsal, without spine, equal two thirds of its distance from the caudal. Dorsal spines well developed and strongly projecting. Pectoral reaching a vertical from the spine of the first dorsal, inner angle rounded. Ventrals not reaching a vertical from the end of the second dorsal. Scales with three parallel keels, each ending in a point, median keel strongest.

Type a female of about twenty-five inches.

Magellan.

Lepidorhinus.

Lepidorhinus Bonaparte, 1838, Nuovi ann. sc. nat. Bologna, **2**, p. 207; 1839, Mém Soc. sci. Neuch., **2**, p. 9 extra.
Machephilus Johnson, 1867, Proc. Zool. soc. London, p. 713.

Body elongate, subround; tail short. Head depressed; snout rather broad, rounded at the end. Nostrils transverse, forward of the middle of the preoral length. Mouth large, crescentic, with a deep groove and with labial folds on both jaws at the angles. Teeth all sectorial, dissimilar in the two jaws; upper pointed, cusp more erect; lower broader, cusp directed toward the angles of the mouth; median tooth present or absent above and below. Spiracles large, opening upward. Eyes large, without nictitating folds. Gill openings medium, in front of the pectoral. Pectorals small, inner angle little produced. Dorsal fins elongate, first dorsal near the pectorals. Caudal short, deep, subcaudal lobe not produced. Scales small, close together, leaf-shaped, pedunculate on the trunk with a strong median keel and weaker laterals, sessile with convergent keels on the snout.

Dorsal spine behind the ends of the pectorals
  hinder angle of pectorals slightly produced
    second dorsal as high as the first . . . *squamosus* (page 211)
Dorsal spine above the ends of the pectorals
  hinder angle of pectorals not produced
    second dorsal much higher than the first
      snout from eye longer than the orbit . *foliaceus* (page 212)
    second dorsal a little higher than the first
      snout from eye shorter than the orbit . *steindachneri* (page 213)
      snout from eye much longer than the orbit . *rossi* (page 214)

Lepidorhinus squamosus.

L'écailleux Broussonet, 1780, Mem. Acad. roy., p. 675; Lacépède, 1798, Poissons, **1**, p. 284, pl. 10, f. 3.
Squalus squamosus Bonnaterre, 1788, Ichth., p. 12; Gmelin, 1789, Linné Syst., **1**, p. 1502; Schn., 1801, Bloch Ichth., p. 156.
Acanthorhinus squammosus Blainv., 1816, Bull. Soc. philom., p. 121; Gray, 1851, Chondropterygii, p. 71.
Centrina squammosus Cuv., 1817, Reg. anim., **2**, p. 130.
Lepidorhinus squamosus Bonaparte, 1838, Nuovi ann. sci. nat. Bologna, **2**, p. 207; 1839, Mém. Soc. sci. Neuch., **2**, p. 9 extra.
Centrophorus squamosus Müller & Henle, 1841, Plagios., p. 90, pl. 34; Duméril, 1865, Elasm., p. 448; Bocage & Capello, 1866, Plagios., p. 27; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 422; Vaillant, 1888, Travailleur et Talisman, Poissons, p. 69, pl. 2, f. 3; Holt & Calderwood, 1895, Trans. Roy. Dublin soc., new ser., **5**, p. 373, pl. 43; f. 1; Goode & Bean, 1896, Mem. M. C Z., **22**, p. 13;

Jensen, 1899, Vid. med., p. 411, pl. 3; Collett, 1903, Suppl. Norges fiske, **2**, p. 19; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 52.

Machephilus dumerili Johnson, 1867, Proc. Zool. soc. London, p. 713.

Centrophorus dumerilii Günth., 1870, Cat. fishes Brit. mus., **8**, p. 422; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 13; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 52.

Centrophorus squamosus var. *dumerilii* Vaillant, 1888, Travailleur et Talisman, Poissons, p. 69, pl. 3, f. 2.

Body robust, cavity little more than three fifths of the entire length including the caudal. Head depressed, tapering. Snout blunt. Nostrils transverse; valve with a short projection. Mouth not greatly arched, farther from the end of the snout than from the first gill opening, with a deep groove and with labial folds at each angle; upper fold longer, not half the length of the jaw. Teeth in 29–35 rows; upper cusps nearly equilateral triangles to sharper, in front erect, laterally more oblique; lower broader, very oblique, the cusp being directed toward the angle of the mouth. Individuals vary in regard to the presence of a median tooth either above or below. Spiracle medium, distant from the eye about half the length of the orbit. Gill openings in front of the pectoral, width less than internarial space. Pectorals small, hardly reaching below origin of dorsal, inner angle slightly produced on large specimens. First dorsal near the bases of the pectorals, length of base about three fifths of the interdorsal space, hind angle produced; spine less than height of fin, less than half exposed. Origin of second dorsal nearly above the axils of the ventrals, base less than half of the space between the dorsals, produced extremity reaching almost to the caudal. Caudal less than one fourth of the total, depth nearly half the length, subcaudal lobe slightly produced. Scales leaf-shaped, on a slender peduncle, with a strong median keel, and with one to two weaker lateral keels at each side, produced behind the edges. The scales on the snout are sessile and have convergent keels like those of *Centrophorus granulosus*. Reaches a length of 56 inches.

Greyish to greyish brown.

Specimen in hand from Setubal, 38 inches in length, a mature male. Prof. L. Vaillant.

Madeira to the North Sea and Iceland.

Lepidorhinus foliaceus.

Centrophorus foliaceus Günth., 1877, Ann. mag. nat. hist., ser. 4, **20**, p. 433; 1887, Challenger rept. Zool., **22**, p. 5, pl. 2, f. A.; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 53.

Lepidorhinus (*Scymnodon*) *foliaceus* Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 631.

Lepidorhinus foliaceus Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 679.

Body moderate, vent about midway from gill openings to end of tail; head depressed; snout broadly rounded. Nostrils transverse, at the end of the

anterior two fifths of the preoral length, internarial space about one fourth of the rostral length from the mouth, anterior valve with a sharp angle. Eye large, length of orbit less than its distance from the end of the snout, or more than twice its distance from the spiracle. Mouth with a deep groove, and with short labial folds on both jaws, at each angle. Upper teeth in front short, triangular and nearly or quite erect in cusp, more oblique at the sides; lower teeth broader with the cusp so much turned toward the angles of the mouth as to bring the inner edge about horizontal. Gill openings, small, in front of the pectoral. Pectorals short, truncate, inner angle not produced. Dorsal spines strong, nearly as high as the fins, exposed one fourth to one third of the length; dorsal fins large, hind angle produced, upper broadly rounded. Origin of first dorsal above the axil of the pectoral, end of fin reaching about three fifths of the distance to a vertical from the ventrals. Second dorsal shorter and higher than the first, hind angle less sharp; origin above the axils of the ventrals, fin reaching a vertical from the origin of the caudal. Ventrals small, extremities below the middle of the second dorsal. Caudal nearly one fifth of the total length; terminal portion subtruncate; subcaudal very little produced anteriorly, separated by a shallow indentation from the terminal. Scales close together, leaf-shaped with a strong median keel and two weaker lateral keels the ends of which are produced.

Grey to greyish brown, uniform.

Type a 16 inch specimen taken by the Challenger in Sagami Sea, Japan, in 345 fathoms.

Lepidorhinus steindachneri.

Centrophorus steindachneri Pietschmann, 1907, Anz. Akad wiss. Wien, **44**, p. 394; 1908, Sitzb. Akad. wiss. Wien, **117**, p. 667, pl. 1, f. 1; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 53.

Body slender, head large, broad, depressed; snout tapering, rounded at the end. Eyes large, nearly as far from the end of the snout as from the first gill opening. Nostrils much nearer to the end of the snout than to the mouth. Spiracles large, less than three diameters behind the edge of the orbit and at a higher level. Mouth broadly curved, with a deep groove and with labial folds at each angle; upper fold less than half the length of the jaw, lower slightly less than upper. Teeth resembling those of *L. foliaceus*, that is, all sectorial, those in the middle of the upper jaws having the outline of an isosceles triangle and being nearly erect, but becoming more oblique laterally, and those on the lower jaws much more oblique and nearly twice as broad. Width of gill openings less than half the length of the orbit, in front of the pectoral. Pec-

torals longer than broad, inner angle hardly produced. Origin of first dorsal above the ends of the bases of the pectorals, fin longer and lower than that of the second dorsal; spine above the ends of the pectoral fins, strong, exposed about one third of its length; hind margin of fin straight, hind angle produced. Origin of second dorsal above the axils of the ventrals, base little shorter than that of the first dorsal, fin higher than that mentioned, hind margin nearly straight, hind angle acuminate, reaching behind a vertical from the origin of the subcaudal, spine strong and longer than that of the first dorsal, about half exposed. Caudal little longer than from head to pectorals, about two fifths as deep as long; subcaudal lobe not produced; a shallow indentation in front of the terminal. Scales small, leaf-shaped, with a strong median keel and weaker lateral keels; hind edge with three points, median longest.

Greyish brown.

Described from seventeen inch specimens, from Japan.

Lepidorhinus rossi.

Centrophorus rossi Alcock, 1898, Ann. mag. nat. hist., ser. 7, **2**, p. 143; 1899, Ill. zoöl. Investigator, pl. 26, f. 3; 1899, Cat. deep-sea fishes Indian mus., p. 13.
Centroscymnus crepidater Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 50 (part).

Snout spatulate, much produced, length from the mouth about half that of the head or nearly one seventh of the total length, two and one half times the internarial space or three times the length of the orbit. Mouth crescentic, considerably protractile, width equal two thirds of the preoral length of the snout, with a groove and labial folds at each angle. Upper teeth triangular, acute; lower very oblique. Angle of pectoral rounded, reaching below the middle of the base of the first dorsal. Origin of first dorsal behind the axils of the pectorals; spine short, little exposed, upper and hinder margins convex, hind angle hardly produced, length of base equal nearly half of the interdorsal space. Second dorsal spine above the middle of the bases of the ventrals, much higher than the first dorsal spine, little more than half as high as the fin. Second dorsal fin little larger than the first, bases about equal and hardly as long as the distance between the caudal and the second dorsal. Ventrals smaller than the second dorsal, ends not reaching the end of the second dorsal base. Caudal nearly one fourth of the total length, lower angle moderately prominent.

Scales minute, acutely and very elegantly tridentate or anchor-shaped.

Uniform jet black.

Type specimen ten inches long, taken in 430 fathoms depth off the Travancore Coast by the Investigator.

Acanthidium.

Acanthidium Lowe, 1839, Proc. Zool. soc. London, p. 92; 1843, Trans. Zool. soc. London, **3**, p. 18.
Deania Jord. & Snyder, 1902, Proc. U. S. nat. mus., **25**, p. 80.
Nasisqualus Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 681.

Body elongate, subfusiform, slightly compressed. Head depressed; snout very long, longer than the remainder of the head, spatuliform, blunt; nostrils in front of the middle, transverse. Mouth behind the mid length of the head, with a deep groove and with labial folds at each angle. Teeth compressed, triangular, sectorial, diverse, cusps erect to very oblique. Eyes large, no nictitating membrane. Spiracles large, superior, behind the eyes. Gill openings narrow, in front of the pectoral. Pectorals moderate, not produced on the inner angle. Two dorsals, each with a compressed spine each side of which bears a groove; first dorsal above the space between pectorals and ventrals, second behind the ventrals. No anal fin. Tail much shorter than the body; lower lobe of caudal hardly produced. Scales very small, each with a slender peduncle on a broad polygonal or radiating base and crowned with three (3–4) slender acuminate cusps.

Species now known from the Northern Atlantic, the Mediterranean, and Japan.

Lowe, 1839, characterized this genus and placed within it two species, *A. pusillum* and *A. calceus*. As *A. pusillum* properly belonged to Etmopterus Rafinesque, 1810, *A. calceus* was really the typical and for many years the only known species of the genus.

First dorsal spine equidistant from end of snout and caudal
bases of the two dorsals about equal
eye nearer to end of snout than to pectoral
teeth cusps near symphysis of lower jaws subhorizontal
calceus (page 216)
base of first dorsal much longer than that of second
teeth near symphysis of lower jaws with erect cusps
aciculatum (page 217)
First dorsal spine nearer to end of snout than to caudal
eye nearer to end of snout than to pectoral
teeth near symphysis of lower jaws oblique on cutting edges
inner angle of pectoral longer
spine of dorsal behind ends of pectorals
rostratum (page 218)
spine of dorsal above ends of pectorals
profundorum (page 219)

First dorsal spine nearer to caudal than to end of snout
eye midway between end of snout and base of pectoral
teeth of lower jaws subhorizontal on cutting edges
inner angle of pectoral shorter . . *hystricosum* (page 220)
eye nearer to pectoral than to end of snout
teeth with small basal cusps
margin of pectoral rounded behind . *eglantina* (page 221)

Acanthidium calceus.

Acanthidium calceus Lowe, 1839, Proc. Zool. soc. London, p. 92; 1843, Trans. Zool. soc. London, **3**, p. 19.
Centrophorus calceus Lowe, 1843, Proc. Zool. soc. London, p. 93; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 423; Vaillant, 1888, Travailleur et Talisman, Poissons, p. 71, pl. 3, f. 1; Moreau, 1891, Poiss. France, Suppl., p. 132; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 14; Collett, 1903, Suppl. Norges fiske, **2**, p. 21; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 51.
Centrophorus crepidalbus Bocage & Capello, 1864, Diag. fam. Squal., p. 2; Proc. Zool. soc. London, p. 262, f. 2; 1866, Plagios., p. 28, pl. 2, f. 1; Capello, 1870, Jor. Acad. sci. Lisboa, **2**, p. 144; Bocage, 1872, Jor. Acad. sci. Lisboa, **3**, p. 88.
Scymnodon ringens Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 11, pl. 4, f. 12 (non Bocage & Capello, 1864).

Body elongate, subfusiform. Head depressed; snout very long, broad, spatuliform, about half the length of the entire head, nostrils transverse, about three fifths of the distance from the mouth to the end. Internarial width less than one third of the preoral length of the head. Mouth wide, with a deep groove and labial folds at each angle. Teeth not serrated, diverse; upper with narrower more erect cusps, becoming oblique toward the angles of the mouth; lower broader, with cutting edge oblique, more nearly horizontal. Spiracles large, opening upward, less than the length of the orbit behind the eye. Gill openings narrow, in front of the pectoral. Pectorals rather small, subtruncate, hind angles rounded, not reaching below the first dorsal spine. Dorsal spine about midway from snout to caudal, compressed, with a groove along each side. Base of first dorsal without the spine little longer than the base of the second, more than half the interdorsal space; end of fin acuminate. Second dorsal higher than the first, spine nearly as high as the fin, base much longer than its distance from the caudal, end of the fin reaching the latter. Axils of the ventrals little in front of the spine of the second dorsal; fins small, narrow, ends below middle of second dorsal. Tail short, about one third of the total length; caudal short, subcaudal angle hardly produced.

Scales minute, with a broad polygonal base and a slender erect peduncle from the top of which the crown bends backward in three slender cusps.

Ashy or greyish brown, uniform or clouded.

Deep waters off Portugal and Madeira.

Acanthidium aciculatum.

Plate 12, fig. 1–4.

Acanthidium aciculatum Garman, 1906, Bull. M. C. Z., 46, p. 207.

Elongate, moderately slender and compressed. Head long, nearly one fourth of the total length; snout produced, depressed, sharp laterally, broad and bluntly rounded at the end superiorly. Nostrils small, their distance apart about two thirds of their distance from the end of the snout, which latter distance is one third of that from the end to the mouth; anterior valve with a short pointed lobe crossing the nostril. Eye large, three sevenths of the length of the snout, hind angle of the orbit above the angle of the mouth. Mouth wide, width nearly half the length of the snout, moderately arched, with a deep groove, more than half of which is anterior, and with labial folds, at each angle; lower fold more than half the length of the jaw, upper shorter and hidden by the groove. Teeth $\frac{30}{31}$; upper with sharp erect triangular cusps rising from the middle of the cutting edges, broadening at the bases, little more oblique near the angles; lower with a group of erect, sharp-pointed teeth near the symphysis, somewhat like those on the upper jaws of *A. hystricosum*, and becoming slightly oblique toward the corners of the mouth; base of cusp much broader than the central portion, Plate 12, fig. 2. Spiracle large, distant less than a diameter from the corner of the eye, valve with laminae like the gills. Gill openings narrow, subequal, about one third of the length of the orbit, in front of the pectoral. Pectorals subquadrate, subtruncate, five eighths as wide as long, not reaching a vertical from the dorsal spine by more than the width of the pectoral fin, angles rounded, inner shorter. First dorsal spine remote from the end of the pectoral, lower than the fin, not half exposed; upper margin of fin in a low continuous curve from the spine to the much produced extremity; two fifths of the base of the fin in the hinder half of the length from end of snout to caudal. Second dorsal much higher than the first, base one fifth shorter; spine nearly as high as the fin, little behind the axils of the ventrals, half or more exposed; acute free portion of the fin nearly reaching the origin of the supracaudal. Ventrals small, ends hardly reaching the middle of the base of the second dorsal without the spine, bases distant from the origin of the caudal one third of the distance from the axils of the pectorals. Subcaudal angle broadly rounded; terminal margin convex; caudal less than one fourth of the total length. Scales very small, slender, pedunculate, each with three slender sharp cusps.

Total length $34\frac{1}{2}$, snout to tail $23\frac{1}{4}$, snout to dorsal spine $14\frac{1}{4}$, snout to pectoral $8\frac{1}{2}$, snout to mouth $4\frac{1}{4}$, and caudal fin 7 inches.

Uniform brown.

Japan. Alan Owston.

Acanthidium rostratum.

Plate **11**, fig. 1–4.

Acanthidium rostratum Garman, 1906, Bull. M. C. Z., **46**, p. 206.
Centrophorus rostratus Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 52.

Moderately robust, elongate, somewhat compressed. Head long, about one fourth of the total length, depressed, width three fifths of the length, flattened on the crown. Snout more than half as long as the entire head, sharp edged as seen from the side, broad and broadly rounded at the end as seen from above. Nostrils small, distant from one another three fifths of their distance from the end of the snout or three sevenths of their distance from the mouth, crossed by a short, angled lobe on the inner side of which lies a smaller one. Eye large, length of orbit two fifths of its distance from the end of the snout. Mouth wide, width nearly two fifths of the length of the snout, little arched; groove moderate; folds short, upper longer. Teeth compressed $\frac{34}{36}$; upper triangular, eight near the middle of the mouth nearly erect, lateral teeth becoming more oblique, with more of a notch on the outer edge; lower larger, oblique, with cutting edge directed outward nearly horizontally above a deep notch on the outer edge. Spiracle large, semilunate, distant its own width up and backward from the orbit. Gill openings moderate, in front of the pectoral, hindmost widest. Pectoral short, oblique subtruncate, outer angle rounded, inner blunt, not produced. Spine of first dorsal behind the end of the pectoral fin, equidistant from the subcaudal and the end of the snout, half the height of the fin, half exposed; base of the dorsal without the spine equal less than three fourths of the snout, less than half of the interdorsal space, or about four fifths of the length of the base of the second dorsal, without its spine; fin low, the much produced hind portion in hinder half of total length. Second dorsal spine above the axils of the ventrals, two thirds as high as the fin, half exposed; base of fin three times the space between it and the supracaudal, equal the space between ventrals and subcaudal, or two sevenths of the space between ventrals and pectorals; hind angle produced, reaching the caudal. Caudal of moderate depth; subcaudal lobe somewhat produced, rounded below, fin narrow in front of the terminal,

from which it is separated by a shallow notch. Scales very small, base stellate to polygonal, peduncle crowned with three (to four) acuminate cusps, along the outer surface of each of which a keel is apparent. Spiral intestine of seventeen circuits.

Total length 34, snout to vent 24, snout to dorsal spine 14, snout to pectoral $8\frac{1}{4}$, snout to mouth $4\frac{3}{4}$, and caudal fin $6\frac{1}{2}$ inches.

Ashy brown, probably greenish in life, darker on head, snout and back and upper parts of fins; a whitish hind border on the pectorals; lighter on the hind margins and inner angles of other fins; lower surfaces lighter.

Yenoura, Suruga Gulf, Japan. Alan Owston.

Acanthidium profundorum.

Nasisqualus profundorum Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 681.

Form elongate. Head broad, depressed. Body and tail compressed; tail short. Snout long, wide, bluntly rounded at the end. Nostrils at nearly two thirds of the distance from the mouth to the end of the snout, transverse, width about equal to their distance apart. The deep straight oblique grooves across each angle of the mouth do not meet in front by less than half their length. Upper teeth triangular, pointed, erect; lower broader, with cutting edges directed toward the sides of the head. Dorsal fins nearly equal in length; anterior lower, its spine half as high as the fin, little exposed, and placed above the hind edges of the pectorals; second dorsal taller, especially so near the spine, which latter is more than half as high as the fin, more than half exposed, and rises above the axils of the ventrals. Ventral fins smaller than the second dorsal, their bases wholly in front of its spine. Origin of supracaudal close to end of second dorsal. Pectorals moderate, rounded at the angles. Claspers of male long, straight, acuminate. Spiracles large, behind the eye and distant from it more than the spiracular diameter. Scales small, pedicellate, each with three sharp cusps, bent backward, of which the median cusp is a little longer. Closely allied to *A. rostratum* but readily distinguished by the origin of the first dorsal which is farther forward, above the ends of the pectorals.

Uniform dark brown.

Of the types a mature male measured 17.3 inches, a female 23.2 inches.

Philippines, between Leyte and Mindanao, at 736 fathoms (736–976), and between Marindugue and Luzon, at 736 fathoms. The depths ranged from 392 to 976 fathoms.

Acanthidium hystricosum.

Plate 11, fig. 5–8.

Acanthidium hystricosum Garman, 1906, Bull. M. C. Z., 46, p. 206.
Centrophorus hystricosus Regan, 1908, Ann. mag. nat. hist., ser. 8, 2, p. 51.

Subfusiform, slender, compressed, depth nearly one eighth of the total length. Head about one fourth of the total, depressed, flattened on the crown. Snout elongate, broad, blunt at the end, narrowing in front of the nostrils. Width of nostrils about half their distance apart, or one third of that from the end of the snout; valves narrow, with a short angular lobe across the middle of the nostril and another smaller one a short distance farther inward. Eye large, length of orbit little more than half of the distance from the end of the snout. Mouth large, width less than half of the preoral length, with a deep straight groove and with labial folds at each angle, upper fold half the length of the jaw, lower shorter. Teeth $\frac{33}{30}$; upper little narrower, cusp triangular, roof-shaped in transsection, erect near the middle of the mouth, more oblique laterally; lower much inclined toward the angles, cutting edge nearly horizontal, a deep notch on the outer edge. Spiracle large, as wide as the first gill opening, above the level of the eye and less than its width farther back. Gill openings in front of the pectorals. Spine of first dorsal short, hardly half exposed, equidistant from orbit and the spine of the second dorsal; base without the spine about half the length of the head, nearly equal the interdorsal space; fin low, upper margin a low arch, hind angle much produced. Second dorsal higher, base about two thirds as long as that of the first, distance of base from supracaudal half their distance apart, spine strong nearly as tall as the fin, rising little behind a vertical from the axils of the ventrals, end of fin reaching the origin of the caudal. Ventrals small, bases almost entirely in front of the origin of the second dorsal, bases about half as long as their distance from the subcaudal. Pectorals moderate, subtruncate on hind margin, inner angle shorter, not reaching quite to the origin of the first dorsal, or little more than halfway to a vertical from the dorsal spine. Scales larger than those of *A. rostratum*, pedicellate with radiate base and with three sharp slender cusps at the summit each bearing a keel on its outer side, a fourth erect cusp frequently occurring above the peduncle.

Dark brown, little lighter below; inside of mouth, gill openings, and nostrils, and edges of fins blackish.

Total length $36\frac{1}{4}$, snout to tail $24\frac{1}{4}$, snout to dorsal spine, $15\frac{1}{2}$, snout to pectoral $8\frac{1}{2}$, snout to mouth 5, and caudal fin 8 inches.

Sagami Sea, Japan. Alan Owston.

Acanthidium eglantina.

Deania eglantina Jordan & Snyder, 1902, Proc. U. S. nat. mus., **25**, p. 80, f. 2; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 632, f. 4.

Head large, nearly one fourth of the total length; snout long, depressed, broad. Eyes large, lateral; front of orbit nearer to tip of snout than to the first gill opening. Nostrils large, about equidistant from end of snout and from eye. Mouth rather wide. Spiracle large, nearer to the eye than to the gill opening. Gill openings in front of the pectoral. Pectorals about as long as the snout, hind margin convex. Base of the first dorsal little behind the ends of the pectorals, fin short, spine little exposed. Spine of second dorsal nearly as high as the fin, half exposed. Ventrals small, entirely in front of the spine of the second dorsal. Caudal elongate, subcaudal lobe not much produced. "Scales each with 3 or 4 short radiating bristle-like spines with two small prickles on each side, the whole body having a ki nd of hairy appearance, and velvety to the touch."

Dark greyish brown, almost black, tips of spinules lighter.

Known from the description of the type, a young female, twelve inches in length, taken in Totomi Bay, Japan, by the Albatross.

Etmopterus.

Etmopterus Rafinesque, 1810, Caratteri, p. 14.
Spinax Bonaparte, 1841, Icon. Fauna, Ital., Pesci; Müller & Henle, 1841, Plagios., p. 86.

Body subcylindrical or fusiform, longer than the tail. Snout produced, broad, blunt; nostrils far forward, near the edges. Eyes large, lateral, shielded by pigment in the upper front of the orbit, without a nictitating membrane. Mouth transverse, not greatly arched, with a deep groove and labial folds at each angle. Teeth unlike; upper raptorial, pluricuspid, resembling those of Centroscyllium; lower sectorial, compressed, blade-like, similar to those of Squalus. Spiracles large, behind the eye at a higher level, opening upward. Two dorsal fins, each with a compressed spine, doubly grooved on each side, hinder spine larger, behind the ventrals. No anal fin. Caudal short, without a pit in front, with a shallow notch between subcaudal and terminal portions. Scales small, with broad quadrangular or radiate bases and with or without an erect cusp. Species small, mostly from great depths, more or less luminous, the young with a common pattern of markings.

Scales stout, erect, short
width of head across the gills greater than the preoral length
princeps (page 222)
Scales setiform, not forming ridges
ventrals much nearer to the caudal than to the pectorals *spinax* (page 223)
ventrals equidistant from caudal and pectorals
spine of first dorsal equidistant from mid orbit and second dorsal
hillianus (page 224)
spine of first dorsal equi distant from end of snout and second dorsal
villosus (page 225)
Scales setiform, forming longitudinal ridges
ventrals of the male equidistant from the pectorals and the caudal
caudal as long as the head . . . . . *lucifer* (page 226)
caudal shorter than the head . . . *brachyurus* (page 227)
Scales placoid, with raised edges;
spine of the first dorsal equidistant from the orbit and the second dorsal
pusillus (page 228)
Scales placoid, with a central spine and with spinules
spine of first dorsal equidistant from spiracle and second dorsal
paessleri (page 229)
Scales granular anteriorly, setiform posteriorly
spine of first dorsal equidistant from spiracle and second dorsal
granulosus (page 230)

Etmopterus princeps.

Etmopterus princeps Collett, 1904, Forh. vid.-selsk. Chra., no. 9, p. 3; 1905, Rept. Norw. fish & mar. invest., **2**, p. 29, pl. 1, f. 1–2.
Spinax princeps Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 44.

"Head rather broad; length of snout (from mouth) less than the width across the gill openings. Scales forming a short radiated spine, its height not exceeding the base of the scale, and allowing the skin to be everywhere visible between the scales.

Gill openings. The anterior wider than the posterior ones, the width being about twice the diameter of the spiracula.

Color blackish brown; membranous margins of the fins bluish.

Size large, total length reaching 728 mm. [about 28.6 inches].

Faroe Channel; Faroe Bank. Depth 750–1200 metres."

Etmopterus spinax.

Galeus acanthias seu *Spinax fuscus: Genuæ, Sagree* Willughby, 1686, Pisc., p. 57; Ray, 1713, Pisc., p. 21.
Squalus pinna ani carens; naribus in extremo rostro Artedi, 1738, Ichthyologia, Syn., p. 95, Gen. 67, no. 4; Walbaum, 1792, Artedi, p. 506.
Squalus spinax Linné, 1746, Fauna Svec., p. 107; 1758, Syst., **1**, p. 233; 1766, Syst., **1**, p. 398; Müller, 1776, Zool. Dan. Prodr., p. 37; Bonnaterre, 1788, Ichth., p. 12; Gmelin, 1789, Linné Syst., **1**, p. 1501, Schneider, 1801, Bloch Ichth., p. 135; Risso, 1810, Ichth. Nice, p. 41; Nilsson, 1832, Prodromus, p. 118; Jenyns, 1835, Man., p. 505.
Squalus niger Gunner., 1763, Act. Nidr., **2**, p. 213, pl. 7, 8.
Le blaataske Ascanius, 1777, Icon., **4**, pl. 37.
Le sagre Broussonet, 1780, Mem. Acad. roy., p. 675.
Le squale sagre Lacépède, 1798, Poissons, **1**, p. 274.
Etmopterus aculeatus Rafinesque, 1810, Caratteri, p. 14, pl. 13, f. 3; Indice, p. 46.
Squalus (Acanthorhinus) spinax Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 60.
Spinax spinax Cuvier, 1817, Reg. anim., **2**, p. 129.
Spinax niger Cloquet, 1820, Dict. sci. nat. Suppl., **1**, p. 93; Agass., 1836, Rech. poiss. foss., **3**, p. 61, 93, pl. A, f. 3, pl. B, f. 4, 5; Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 58, f. 1; Müller & Henle, 1841, Plagios., p. 86; Gray, 1851, Chondropterygii, p. 71; Kröyer, 1853, Danm. fiske, **3**, p. 893; Nilsson, 1855, Fisk. Skand., **4**, p. 729; Duméril, 1865, Elasm., p. 441, pl. 4, f. 13, 14; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 424; Canestrini, 1872, Ital. pesci, p. 40; Gerv. & Boul., 1876, Poiss. Fr., **3**, p. 209, pl. 80, f. 27; Moreau, 1881, Poiss. France, **1**, p. 348, f. 59; Doderlein, 1881, Man. ittiol. Medit. **2**, p. 96; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 43.
Acanthias spinax Risso, 1826, Hist. nat., **3**, Poissons, p. 132.
Squalus gunneri Reinhardt, 1828, Kongl. Dansk. selsk. Förh., **3**, p. 16.
Centrina nigra Lowe, 1843, Proc. Zool. soc. Lond., p. 144; Trans. Zool. soc. Lond., **3**, p. 19.
Etmopterus spinax Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 10 (non fig.); Garman, 1899, Mem. M. C. Z., **26**, p. 27; Braganca, 1904, Res. inv. Amel., **2**, p. 61, pl. 2, f. 1; Jensen 1907, Dan. fiske, p. 312, pl. 29, f. 1–1 f.

Head nearly one fifth of the total length, broad. Snout long, subangular in front of the orbits, rounded at the end, preoral length about half the head from the pectorals; nostrils midway from the end to the orbit, anterior nasal valve acuminate at its outer angle. Orbits longer than their distance from the end of the snout. Spiracles moderate, backward and upward from the orbit half the length of the eye. Width of mouth little less than its distance from the end of the snout; each angle with a deep, short, straight groove, and a pair of short equal labial folds. Teeth $\frac{27-31}{36-40}$; upper median cusp much longer and stronger than the pair (1–3) of lateral cusps at each side of its base; cutting edge of lower teeth oblique, nearly horizontal, slightly curved. Gill openings as wide as the spiracles, in front of the pectoral. Pectorals short, subtruncate, angles rounded, not reaching to the origin of the dorsal by about one length of the orbit. Spine of the first dorsal midway from the orbit to the spine of the second, or midway from the end of the snout to the hinder end of the base of the second dorsal, half the height of the fin, half as long as the spine of the second dorsal. Base of first dorsal without the spine one sixth of its distance from the second, three fourths as long as the base of the second without the spine. Second dorsal much

larger than the first, spine above the hind parts of the bases of the ventrals, base behind the spine little more than half its distance from the supracaudal; upper angle rounded, hinder produced; hind margin concave. Origins of ventrals midway from the middle of the orbit to the end of the caudal. Caudal nearly one fourth of the total length, subcaudal angle little produced, a shallow notch below in front of the terminal. Scales setiform, rather closely and uniformly placed.

Total length $17\frac{1}{2}$, snout to vent $10\frac{1}{2}$, snout to dorsal $5\frac{5}{8}$, snout to pectorals $3\frac{3}{8}$ snout to mouth $1\frac{1}{2}$, and caudal $4\frac{3}{8}$ inches.

Back and flanks rusty brownish on the northern variety, *E. spinax,* darkening with age, brown to black on the southern variety, *E. niger;* lower surfaces black. The black areas are similar to those shown for *E. hillianus,* Plate **10**, fig. 1, the pattern apparently being generic. The young of the two varieties are much alike. A specimen of the southern form from Nice, of less than four inches in length shows the back light brownish and the belly black; a white area extends back from the eye to meet a white band from the angle of the mouth and another farther back in front of the gill opening extending forward toward the symphysis of the lower jaws; a white band above the bases of the pectorals runs back to the pelvis where it sends a process in front of the ventral then continues above its base and behind it under the tail unites with its fellow from the other side; behind this junction there is a transverse area which on the lower half of the flank expands forward beyond the ventral and backward below the second dorsal; above the light band at the side of the abdomen there is an indefinite band of dark; a streak of dark marks the course of the lateral line on the side; below the base of the pectorals and on the ventrals and along each side of the subcaudal base appear short bands or lines of dark; the bases of the dorsal spines are black as are also the lower angle of the subcaudal and the end of the terminal fin; and there is a white spot on the fontanel and one above the hind part of each orbit. The lower edge of the upper portion of the forward half of the orbit, as in other species, is pigmented with black; an aid to vision functional in connection with luminosity.

Mediterranean Sea and northward off the coasts of Europe.

Etmopterus hillianus.

Plate **10**, fig. 1–4.

Spinax hillianus Poey, 1861, Memorias Cuba, **2**, p. 34, pl. 19, f. 13–14; 1868, Repertorio, **2**, p. 454; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 44.
Spinax spinax Poey, 1876, An. Soc. Esp. hist. nat., **5**, p. 203.
Etmopterus pusillus Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 10, pl. 2, f. 5

Head broad, moderately convex across the crown; snout wide, deep, produced, length about equal to the distance from the mouth to the third gill opening, end blunted; nostrils rather more distant from the end than from the eye, nearly as wide as the internarial space. Orbit longer than the preorbital length. Mouth large, width little less than the preoral length of the snout, with a short, deep, straight groove and short labial folds the upper of which is twice as long as the lower, at each angle. Teeth $\frac{27}{36}$, upper with a somewhat longer median cusp at each side of which there are from two to four shorter lateral cusps shortening from the median; lower with cutting edge nearly horizontal and straight. Spiracle moderate, midway from the nostril to the pectoral, width about equal that of the internarial space. Gill openings as wide as the spiracles, hindmost widest and its upper end in front of the pectoral. Pectorals small, hardly reaching the origin of the first dorsal, hind margin subtruncate, inner angle broadly rounded. Spine of first dorsal midway between the middle of the eye and the spine of the second dorsal; base without the spine equal the length of the spine or two thirds of the base of the second dorsal. Spine of second dorsal slender, crooked, equal the length of the orbit; upper angle of fin bluntly rounded, hind angle acuminate; base excluding the spine equal half the width of the mouth, one third of the distance from the caudal, or one fourth of the interdorsal space. Origin of ventrals midway from axil of pectoral to subcaudal; ends of the fins below the spine of the second dorsal; claspers of male short, extending little beyond the ends of the fins. Caudal about one fourth of the total length; subcaudal with a moderately prominent lower angle and separated from the terminal by a shallow notch; terminal somewhat pointed. Scales slender, hooked, with broad bases, Plate **10**, fig. 4.

Brown on back and sides; black below; whitish on the distal portions of dorsals and paired fins and in the middle of the caudal; the black areas are well shown on Plate **10**, fig. 1. There is a white spot on the fontanel, and another above the hinder part of each orbit.

Specimen described and figured an adult male of $9\frac{3}{4}$ inches from a depth of 208 fathoms, off St. Kitts, W. I.

Etmopterus villosus.

Etmopterus villosus Gilbert, 1905, Bull. U. S. fish comm., **23**, p. 580, pl. 66.
Spinax granulosus Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 44.

Snout broad, bluntly rounded, length from the eye shorter than the space between orbit and first gill opening. A deep groove at each angle of the mouth.

Teeth $\frac{27}{29}$; each upper tooth with a central cusp and a pair of shorter lateral cusps; cutting edges of lower teeth nearly horizontal. Orbit longer than its distance from the end of the snout. Pectoral short, not reaching the dorsal spine, subtruncate. First dorsal smaller than the second; spine midway from end of snout to supracaudal, two thirds as long as that of the second dorsal; origin slightly behind the ends of the pectorals. Interdorsal space about equal the distance from second dorsal to supracaudal, about three times the length of the base of the first dorsal without the spine, or a little less than the distance from the axils of the ventrals to the subcaudal, which last distance is nearly two thirds of that from the bases of the pectorals to those of the ventrals. Skin closely set with small placoid scales arranged in longitudinal series on back and tail, each scale bearing a slender spine. Fins naked, except on basal portions.

Brown; blackish below; hind borders of fins lighter to white.

Type nearly 6.7 inches in length (170 mm.), taken off the south coast of Molokai, at a depth between 222 and 498 fathoms.

Etmopterus lucifer.

Etmopterus lucifer Jordan & Snyder, 1902, Proc. U. S. nat. mus., **25**, p. 79; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 634, f. 5; Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 679; Tanaka, 1912, Fishes of Japan, **8**, p. 133, pl. 36.

Spinax? *lucifer* Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 45.

Head less than one fifth of the total length, tapering slightly from the spiracles forward. Snout produced, deep, broad to the nostrils, thence blunt-pointed, rounded at the end; nostrils half way from the end to the eye, anterior valve acuminate at the outer edge. Eye large, length of orbit one and one fourth times its distance from the end of the snout, about twice its distance from the nostrils, more than twice its distance from the spiracles. Mouth little arched, width equal two thirds of the preoral length, with a short deep groove and short equal labial folds at each angle. Teeth $\frac{27}{36}$; upper with a strong and much longer median cusp at each side of the base of which is a pair of short cusps the outer of which is very small; lower cutting edge nearly horizontal and straight. Gill openings, hardly as wide as the spiracles, hindmost widest, in front of the pectorals. Pectorals short, broad, not reaching the origin of the first dorsal, subtruncate, inner angle broadly rounded. Origin of dorsal nearly midway from end of snout to second dorsal; spine about half as long as that of the second dorsal, rather slender; base without the spine three fourths of that of the second, hardly one sixth of the interdorsal space; fin short, hind angle slightly produced. Spine of second dorsal twice as long as that of the first; base of fin

one third of the distance from the caudal; origin above the axils of the ventrals. Ventrals reaching little behind the spine of the second dorsal. Caudal two sevenths of the total length, separated at the terminal by a shallow notch, lower angle hardly developed, broadly rounded. Scales with short setiform spines arranged in more or less regularly longitudinal series on the upper surfaces, the flanks, and below the tail, everywhere except in the heavily pigmented areas of black on the lower surface and lower part of the flank near the base of the tail. In the black areas, the outlines of which somewhat closely agree with those of *E. hillianus*, Plate 10, fig. 1, the spines appear evenly distributed.

Back and flanks blackish brown, the brown separated from the black of the lower surfaces by longitudinal bands of whitish, probably becoming uniform black with age. Young specimens much lighter. In the specimens described the markings are closely similar to those of *E. hillianus* and *E. spinax:* there is a whitish spot on the forehead, another behind each orbit, an oblique band from the forward gill opening, a longitudinal from above and behind each pectoral along the flank at the edge of the black to a point above the base of the ventral where a branch is sent in front of the pelvis while the band ends behind the fin against a dark area which passes up to the flank and extends a narrowing band forward above the ventral and backward below the second dorsal; except in the basal portions and in the end of the tail the fins are light.

Total length of an adult male $11\frac{1}{2}$, snout to vent 6, snout to dorsal spine $3\frac{5}{8}$, snout to pectoral $2\frac{3}{8}$, snout to mouth $1\frac{1}{8}$, and caudal $2\frac{3}{4}$ inches.

Odawara, Japan.

Etmopterus brachyurus.

Etmopterus brachyurus Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 679, fig. 2, pl. 52.

Distinguished from *Etmopterus lucifer* by the much shorter caudal fins and by the origin of the second dorsal, which is behind the tips instead of above the axils of the ventral fins. Lines of sharp spines appear on both species. The head of *E. brachyurus* is broader, the mouth wider and the snout shorter than in *E. lucifer*. Width of mouth and length of snout (*i. e.* distance from mouth to end of snout) about equal. Snout broad, depressed. Origins of the ventrals little behind midway from the origin of the first dorsal to that of the second. Origin of the first dorsal above the ends of the pectorals. Nostrils large, near the end of the snout, internarial space wider. Upper teeth small, five-cusped. Lower teeth larger, one-cusped, cutting edge rising obliquely outward. Spiracles rather large, near midway from the end of the snout to the hindmost gill opening.

Numerous lines of spine-like scales along the body and head, larger on the tail. Dorsal spines prominent, hinder larger. Caudal short and rather deep.

It is stated in the original description that the claspers are short and provided with four long sharp spines and that in order to accommodate these organs the fins cross one another at right angles. The meaning of this is not at all clear. The benefit reached by "crossing one another at right angles" is not evident; besides, the figure published shows the ventral fins to be like those of *E. lucifer* in which that position is hardly possible.

Color: — above light brown, below darker; all fins pale yellowish brown. Black areas and light stripes along the lower flank above the ventrals and forward, like those on *E. lucifer*, are not indicated; if absent from *E. brachyurus* these marks form additional means to distinguish the species.

The type, an adult male of 8.5 inches, was taken near Jolo, at 263 fathoms.

Etmopterus pusillus.

Acanthidium pusillum Lowe, 1839, Proc. Zool. soc. Lond., p. 91; 1849, Trans. Zool. soc. Lond., **3**, p. 19.
Spinax pusillus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 425; Vaillant, 1888, Travailleur et Talisman, Poissons, p. 72; Collett, 1890, Bull. Soc. zool. France, **15**, p. 219; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 44.
Etmopterus pusillus Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 55; Braganca, 1904, Res. inv. Amel., **2**, p. 65, pl. 2, f. 2; Tanaka, 1912, Fishes of Japan, **6**, p. 88, pl. 22.
Etmopterus frontimaculatus Pietschmann, 1907, Anz. Akad. wiss. Wien, **44**, p. 395; 1908, Sitzb. Akad. wiss. Wien, **117**, p. 654, pl. 1, f. 2, pl. 2, f. 2.

Head little less than one fourth of the total length, depressed, crown slightly convex transversely. Snout broad, length from the eye about equal the length of the orbit, bluntly rounded at the end; nostrils midway from the end to the eye. Eye large, orbit nearly half the preoral length, with a crescent-shaped translucent area at the edge above the hinder half of the eye of possible utility in connection with luminosity. Hind corner of the eye above the angle of the mouth, near midway from the end of the snout to the pectoral. Mouth wide with a deep groove and short labial folds on both jaws at the angles. Teeth $\frac{27}{42}$; upper with a long straight median cusp and a short lateral one at each side of its base, hindmost tooth like the lower; lower cutting edge oblique, the cusp being obliquely turned toward the angle of the mouth. Pectorals not reaching the origin of the first dorsal, subtruncate on hind margin, inner angle rounded. First dorsal much narrower than the second; base without the spine little more than half as long; spine midway from orbit to spine of second. Origin of second dorsal above the axils of the ventrals; spine nearly twice the height of that of the first, nearly as high as the fin; hind border of fin concave, hind angle much

produced. Ends of ventrals reaching little behind the spine of the second dorsal. Caudal less than one fourth of the total length; subcaudal deep, slightly lobed anteriorly, concave and narrow posteriorly, separated from the terminal by a shallow notch. Scales small, irregular, variable, diverse on different parts of the body; commonly with a broad tetragonal four-pronged base under the skin, and a small exposed quadrangular superstructure surrounded by a ridge with or without serrations or spinules and with the hindmost angle produced in a depressed spine. In some cases the crown of the scale is concave, in others convex, in still others it forms a tubercle or short spine.

Back brown; lower surfaces black. Colors, shapes, and positions of areas closely resembling those of *E. hillianus*, Plate 10, fig. 1, and *E. spinax*. Inside of upper forward half the orbit is heavily pigmented as an ocular shield. Inside of mouth black.

Total length of a specimen from Madeira $11\frac{1}{2}$, snout to vent 7, snout to first dorsal $4\frac{1}{4}$, snout to pectoral $3\frac{5}{8}$, snout to mouth $1\frac{1}{4}$, and caudal $2\frac{5}{8}$ inches.

Madeira; Japan.

Etmopterus paessleri.

Etmopterus paessleri Lönnberg, 1907, Hamb. magal. sammelreise, Fische, p. 5, fig. 1; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 43.

Head broad, more than one fifth of the total length. Snout short, measured from the eye, three tenths or a little more of the length of the head, nostrils about midway from the end to the orbit. Hind corner of the orbit above the angle of the mouth, midway from the end of the snout to the pectorals. Upper teeth with a long, projecting median cusp, lateral cusps indistinct. Spiracle large, equidistant from the middle of the eye and the first gill opening. Foremost and hindmost gill openings nearly equal, about as wide as the spiracles. Dorsal spines small, distance between them about equal that between the foremost and the spiracle; neither reaches half the height of its fin; exposed portions short. Spine of first dorsal little behind the hind border of the pectoral; spine of second nearly above the ends of the bases of the ventrals. Distance between the end of the base of the second dorsal and the end of the caudal about as long as that from the first dorsal to the end of the snout. Skin, except on the lips, covered with small placoid scales, each of which has a central larger spine and several smaller lateral spines. Closely allied to *E. granulosus*.

Black.

Smyth Channel, Strait of Magellan.

Etmopterus granulosus.

Spinax granulosus Günther, 1880, Challenger rept. Zool., **1**, p. 19, pl. 2, f. C.; 1887, Challenger rept. Zool., **22**, p. 4; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 44.

Snout blunt, much produced; symphysis of lower jaws midway from end of the snout to the pectorals. Skin finely granulated, the granules being serially arranged on the tail, where they appear rather in the form of minute spinelets. Scales absent from the internarial space, below the median line of the snout, the circumference of the mouth, the base of the fins, and the back of the tail. Pectorals nearly reaching the first dorsal, truncated. First dorsal midway from spiracles to second, shorter than the latter. Spine of second dorsal three times the size of that of the first, not much lower than the fin; base equal one third of the interdorsal space. Ventrals reaching below the middle of the second dorsal.

Type a male of ten and one half inches.

Black, hind margins of fins white.

Southwest coast of South America in 120 fathoms.

Centroscyllium.

Centroscyllium Müller & Henle, 1841, Plagios., p. 191.
Paracentroscyllium Alcock, 1889, Ann. mag. nat. hist., ser. 6, **4**, p. 379.

Body elongate, fusiform; tail shorter than the body cavity. Head broad; snout short, depressed, blunt. Nostrils oblique, in the forward half of the snout. Mouth wide, moderately arched, with a deep groove and labial folds at each corner. Teeth small, raptorial, with three to seven sharp cusps. Eye large, orbit elongate, no nictitating membrane. Spiracle behind the eye, at a higher level, opening upward. Gill openings narrow, in front of the pectorals. Pectorals moderate, inner angle not produced. Dorsal spines much exposed, grooved longitudinally on each side. First dorsal near the pectorals, second behind the ventrals. No anal fin. Caudal without pits; subcaudal deep, without a much produced lobe. Scales small, commonly with broad base and slender acuminate cusp.

Teeth 5 cusped on the lower jaws
  scales spinulate, with stellate bases . . . . *nigrum* (page 231)
Teeth 3 cusped on both jaws
  scales spinulate, with stellate bases
    snout from eye equal length of orbit . . *fabricii* (page 231)

snout from eye equal less than length of orbit
spine of first dorsal behind ends of pectorals *ritteri* (page 232)
spine of first dorsal above ends of pectorals *ornatum* (page 233)
scales coarser granulations . . . . *granulatum* (page 233)

Centroscyllium nigrum.

Centroscyllium nigrum Garman, 1899, Mem. M. C. Z., **24**, p. 28, pl. 1, f. 2, pl. 4–5, pl. 69, f. 1; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 40.
Centroscyllium ruscosum Gilbert, 1905, Bull. U. S. fish comm., **23**, p. 580, fig. 230.

Moderately slender and elongate. Head large, broad, depressed, from snout to pectorals little more than one fourth of the total length. Snout broadly rounded in front, length about equal to width of forehead, nostrils nearer to end than to eye. Eye large, orbit longer than the snout. Mouth wide, moderately arched, with a deep straight groove and with labial folds on both jaws at each angle. Upper teeth with three cusps and two rudiments, lower with five cusps; median cusp largest. Gill openings hardly as wide as the eyes, in front of the pectorals. Dorsal spines long and slender, hindmost one and one half times as long as the foremost, each spine with two grooves along each side. Origin of first dorsal above axils of pectorals, origin of the second above the hind ends of the bases of the ventrals. Scales small, with stellate bases and slender acuminate, erect, hooked cusps, not very closely placed.

Black.

Taken in the Pacific between 6° and 7° north latitude and between 81° and 82° of west longitude at depths of 546 to 555 fathoms. Albatross.

Centroscyllium fabricii.

Plate **10**, fig. 5–8.

Spinax fabricii Reinhardt, 1828, Dansk. selsk. Forh., **3**, p. 16.
Centroscyllium fabricii Müller & Henle, 1841, Plagios., p. 191; Duméril, 1865, Elasm., p. 449; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 425; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 16; Günther, 1887, Challenger rept. Zool., **22**, p. 6; Vaillant, 1888, Travailleur et Talisman, Poissons, p. 72; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 11, pl. 2, f. 7; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 56, pl. 8, f. 26; Collett, 1905, Rept. Norw. fish. & mar. invest., **2**, p. 25; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 40.

Elongate fusiform; head short, slightly more than one fifth of the total length, broad, depressed; snout short, length from the mouth equal the width of the mouth, or more than twice the internarial space. Nostrils large, entirely in the front half of the snout near the end; valve with a pointed lobe. Mouth very wide, distance of angles from end of snout and from third gill opening about

equal, with a deep and rather short groove and short labial folds, one fourth as long as the jaw, at each angle. Teeth small, compressed, with three sharp pointed cusps of which the median is largest, in about 70 rows. Eye large, length of orbit equal its distance from the end of the snout. Spiracle about once its diameter farther back from the edge of the orbit, at a level above the eye, opening upward. Gill openings in front of the pectoral, width about two thirds the length of the orbit. Pectorals less than twice as long as broad; margins all convex, hinder oblique; inner angle longer than the outer but not produced. First dorsal entirely in the forward half of the total length, spine behind the ends of the pectorals; length of base without the spine one fifth of the distance between the two spines, or equal the length of the base of the second dorsal, or half the distance from the base of the latter to the supracaudal fin, upper margin broadly curved and continued to the hinder angle, which latter is hardly produced. Second dorsal somewhat larger than the first, depth about one and one half times that of the first, hind margin little concave, upper angle blunted, hind angle produced; spine above the axils of the ventrals, one half longer than that of first dorsal, half or more exposed. Caudal of moderate depth, about two fifths of the total length; subcaudal deep, lobe not produced, separated from the terminal by a shallow notch. Scales minute, with broad radiate base from which rises a slender sharp and hooked spine.

Uniform dark brown.

Atlantic, Greenland to New York.

Centroscyllium ritteri.

Centroscyllium ritteri Jordan & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 635.

Head very broad, depressed; snout short, broad, rounded in front. Eye large. Nostrils large, midway from eye to end of snout. Mouth about midway from end of snout to first gill opening, a labial fold at the corners. Teeth tricuspid, alike in the two jaws. Spiracles large. Pectorals short, broad, angles rounded, hind border subtruncate, not reaching below the first dorsal. Dorsal spine immediately behind the ends of the pectorals; hind border of fin oblique. Spine of second dorsal above axils of ventrals, much taller than that of the first, nearly as high as the fin, more than half exposed, placed nearly halfway from the gill openings to the end of the tail; fin rather longer than that of the first dorsal; base, excluding the spine, equal about one half its distance from the supracaudal, or about one fourth of the distance between the two spines. Caudal moderate, nearly equal in length to the distance from one dorsal spine to the other.

Scales scattered small single prickles. Type $16\frac{1}{2}$ inches.

Uniform dark brownish, darker in front below; all fins more or less broadly edged with white (young).

Misaki, Japan.

Centroscyllium ornatum.

Paracentroscyllium ornatum Alcock, 1889, Ann. mag. nat. hist., ser. 6, **4**, p. 379; 1894, Ill. zoöl. Investigator, pl. 8, f. 3.

Centroscyllium ornatum Alcock, 1896, Journ. Asiatic soc. Bengal, **65**, p. 308, 310; 1899, Descr. cat., p. 14; 1900, Ill. zoöl. Investigator, pl. 35, f. 1; Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 41.

Body subcylindrical; head broad, depressed; snout short, wide. Nostrils large, near the edge of the snout. Mouth rather wide, crescentic. Teeth small, tricuspid in both jaws. Eyes very large, length of orbit one fifth of that from snout to pectorals, or four fifths of that of snout. Spiracles rather small. Dorsal spines very strong and acuminate, the second nearly twice the size of the first. From the figure the first dorsal spine appears to be above the inner angles of the pectorals and the spine of the second dorsal close behind the axils of the ventrals. Scales minute, placoid, a stelliform base from which rises a sharp slender spine. The illustration is that of a robust bodied shark, with a caudal of which the subcaudal portion has considerable depth but is without a produced lobe, and of which the terminal portion is much elongated. The specimen figured was nearly one foot in length.

Black.

Bay of Bengal 405–285 fathoms. Arabian Sea 690–620 fathoms.

Centroscyllium granulatum.

Centroscyllium granulatum Günther, 1887, Challenger rept. Zool., **22**, p. 7.

"Specifically, it must be very closely allied to *Centroscyllium fabricii*, having the same disposition of the fins, size of teeth and dorsal spines, but the epidermoid productions of the head and body are much coarser, and in the form of granulations, whilst in *Centroscyllium fabricii* they are minute."

Type 11 inches in length.

Port Stanley, Falkland Islands, in 245 fathoms. Challenger.

Scymnorhinidae.

Body subfusiform, cavity more than half of the total length. Snout subconical. Eyes without a nictitating fold. Mouth transverse, with labial folds. Teeth dissimilar in the two jaws; upper raptorial, lower sectorial. Spiracles

small. Gill openings moderate to narrow. Two small dorsals, spine absent or rarely rudimentary. No anal fin. Tail short, without lateral folds or caudal pits. Scales uniform.

Head subconical
- first dorsal small, behind the pectorals, spine absent or small
  - second dorsal much longer than the first . *Euprotomicrus* (page 234)
- first dorsal small, behind the pectorals, spine absent
  - second dorsal nearly equal the first, near the pectorals *Scymnorhinus* (page 236)
  - second dorsal nearly equal the first, near the ventrals *Isistius* (page 237)

Head depressed; eyes small
- first dorsal small, behind the pectorals
  - second dorsal smaller . . . *Heteroscymnus* (page 239)
  - second dorsal about equal the first . . *Somniosus* (page 240)

Euprotomicrus.

Euprotomicrus Gill, 1864, Proc. Acad. nat. sci. Phil., p. 264.
Squaliolus Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 683.

Body elongate, fusiform. Snout short, subconical; nostrils near the end. Mouth transverse, with a deep straight groove at each angle. Upper teeth small, subulate; lower larger, compressed, smooth-edged, with sharp somewhat oblique cutting edges. Eyes without nictitating folds. Spiracles rather wide, behind the eye. Gill openings narrow, in front of the pectorals. First dorsal small, without or with a small spine, behind the pectorals. Second dorsal much longer, without a spine. No anal fin. Caudal short and deep. Scales minute, flattened, uniform.

First dorsal distant from the pectorals, little behind mid length
- spine absent or rudimentary
  - a median tooth in the lower jaw . . . *bispinatus* (page 235)
  - teeth of a lower series 17. Base of first dorsal $\frac{1}{5}$ of that of second, interspace six times the former. Hind edge of orbit above mouth. Vertical diameter of spiracles $\frac{1}{3}$ that of orbit.
  - head $\frac{5}{28}$ of total length . . . . . *hyalinus* (page 235)

First dorsal near pectorals, in front of mid length
- spine small, not much exposed
  - pectorals reaching little behind origin of dorsal *laticaudus* (page 235)

Euprotomicrus bispinatus.

Leiche laborde Quoy & Gaimard, 1824, Voy. Uran., Poiss., p. 197, pl. 44, f. 1–2.
Scymnus bispinatus Quoy & Gaimard, 1824, ibid., pl. 44, f. 1, 2.
Scymnus mauritianus Quoy & Gaimard, 1830, Dict. class. hist. nat., Atlas, pl. 114 (Poiss., **22**, pl. 45).
Scymnus (Laemargus) labordii Müller & Henle, 1841, Plagios., p. 94.
Dalatias (Somniosus) bispinatus Gray, 1851, Chondropterygii, p. 77.
Euprotomicrus labordii Gill, 1864, Proc. Acad. nat. sci. Phil., p. 264; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 428; Waite, 1907, Rec. Canterb. mus., **1**, p. 8.
Laemargus labordii Duméril, 1865, Elasm., p. 457.

Snout blunt, rounded in front; nostrils anterior, valves short, broad, with a sharp point. Lower teeth 23; median tooth small, erect, the others slightly oblique in the cusp. Pectorals small, subtruncate. First dorsal very small, in front of the ventrals, less than one fourth as long as the second. Second dorsal much longer than the first, placed above the space between the ventrals and the caudal and half as long; origin close behind the bases of the ventrals. Caudal short, deep, subcaudal portion forming a lobe in front, concave on the hind margin, separation between terminal and subcaudal a shallow notch. Scales small, resembling those of Isistius, four-cornered with a central depression on the crown.

Uniform dark brown, pectorals dark at the base lighter outward.

Indian Ocean; Mauritius; New Zealand.

Euprotomicrus hyalinus.

Euprotomicrus hyalinus R. S. Eigenmann, 1890, Proc. Cal. acad. sci., ser. 2, **3**, p. 35.

The type described under this name was taken in the Pacific between San Francisco and Honolulu nearer the latter. The colors were given as dark seal-brown, lighter below, edges of caudal, dorsals, entire ventrals, and mostly the pectorals hyaline. A narrow basal band of the pectorals and dorsal margin, with a spot posteriorly, black. A doubtful species hardly separated from *E. bispinatus* by the particulars noted.

Euprotomicrus laticaudus.

Squaliolus laticaudus Smith & Radcliffe, 1912, Proc. U. S. nat. mus., **41**, p. 684, f. 4, pl. 54.

Form elongate slender subfusiform, slightly compressed. Body cavity long; caudal section short, tapered. Head long, nearly $\frac{1}{3}$ of the total length, slightly depressed; snout pointed. Eye large, lateral; orbit less than half the length of the distance from the end of the snout. Nostrils large, about half way from

eye to end of snout or $\frac{2}{3}$ of the distance from the mouth to the tip. Spiracles large, above the level of the eye and one ocular diameter farther back. Gill openings narrow, in a shallow groove, in front of the pectoral bases. Mouth not large, nearly transverse, with a long groove behind each angle. Teeth in the upper jaw erect or curving backward, subulate. Lower teeth larger, with a cusp on the inner half directed obliquely outward. Scales minute, flattish, topped with a rounded centre surrounded by a ridge forming a tetrangular enclosure from each corner of which the ridge extends toward each corner of the base. Pectorals short, broad, rounded on the angles, reaching little behind the dorsal spine. First dorsal short, low, origin little in front of the end of the pectoral; spine about half as high, not greatly exposed. Second dorsal long, low; origin nearly half way from that of the first dorsal to the end of the caudal, above the axil of the ventral. Caudal short, deep, vertebral axis slightly raised. Ventrals short; as in *E. bispinatus*, the ends are plate-like, and there is "a long slender spine from the anterior and outer base, bifid at the tip."

Uniform jet black, fins whitish toward outer margins, a black spot on the upper edge of the pectoral.

Type a male of 5.9 inches, taken in Batangas Bay, Luzon, at a depth of 170 fathoms.

Scymnorhinus.

Scymnus Cuvier, 1817, Reg. anim., **2**, p. 130 (non Kugelann, 1794).
Scymnorhinus Bonaparte, 1846, Cat. pesci Eur., p. 16.

Elongate, fusiform; tail shorter than the body. Snout subconical, bluntly rounded at the end. Nostrils anterior; valve with a rounded lobe, the inner half. Mouth transverse with a deep straight groove and labial folds at each angle. A villous upper lip in front of the teeth. Upper teeth raptorial, lanceolate; lower sectorial, compressed, serrated on the edges, nearly erect in the middle of the mouth. No nictitating folds. Spiracles wide, transverse, behind the eye, at a higher level, opening upward. Gill openings rather small. Dorsals short, without a spine, first before the ventrals. No anal fin. Caudal large, subcaudal deep. Scales minute, carinate. Doubtfully known from Miocene and later.

Scymnorhinus licha.

Le liche Broussonet, 1780, Mem. Acad. roy., p. 677; Duhamel, 1782, Traité, **4**, p. 301, 328.
Squalus licha Bonnaterre, 1788, Ichth., p. 12.
Squalus americanus Gmelin, 1789, Linné Syst., **1**, p. 1503; Schneider, 1801, Bloch Ichth., p. 136.
Squalus liche Lacépède, 1798, Poissons, **1**, p. 279, pl. 10, f. 3.
Squalus nicaeensis Risso, 1810, Ichth. Nice, p. 43, pl. 4, f. 6; 1826, Hist. nat., **3**, Poissons, p. 137, pl. 2, f. 4.

Squalus lichia Cuv., 1817, Reg. anim., **2**, p. 130; Agass., 1835, Rech. poiss. foss., **3**, pl. F, f. 7; Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 55; Müller & Henle, 1841, Plagios, p. 92; Duméril, 1865, Elasm., p. 452; Bocage & Capello, 1866, Plagios., p. 34; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 425; Canestrini, 1872, Ital. pesci, p. 41; Gerv. & Boul., 1877, Poiss. Fr., **3**, p. 210, pl. 81, f. 28; Moreau, 1881, Poiss. France, **1**, p. 358, fig. 62; Doderlein, 1881, Man. ittiol. Medit., 2, p. 100.
Squalus (Acanthorhinus) americanus Blainv., 1830, Poiss. Fr., p. 63, pl. 15, f. 2.
Scymnorhinus lichia Bonaparte, 1846, Cat. pesci Eur., p. 16.
Dalatias lichia Gray, 1851, Chondropterygii, p. 75.

Moderately slender, body cavity about three fifths and caudal fin about one fourth of the total length. Snout subconical, bluntly rounded. Nostrils anterior; valve a rounded lobe in its inner half. Eye large, orbit nearly as long as the snout, longer than the distance from the spiracle. Mouth transverse with a deep straight groove and with labial folds on both jaws at the angles. A villous upper lip in front of the upper teeth is not entirely distinct. Teeth dissimilar, more oblique toward the angles of the mouth, in $\frac{19}{19}$ rows; upper lanceolate, slender, pointed, several series in function; lower broader, sectorial, with triangular serrated cusp, one series in function except when about to be shed. Spiracles large. Gill openings narrow, hindmost pair closer together, lower end of hindmost one in front of the pectorals. Pectorals small, angles rounded, reaching a vertical from the origin of the first dorsal. Base of dorsal short, nearly equal to length of orbit, distance from the ventrals more than twice that from the pectorals, fin narrow, hind border convex. Base of second dorsal one and one half times that of the first, origin above the hinder third of the ventral, hind margin concave, hind angle produced, extremity reaching nearly to the caudal. Ventrals moderately broad, outer angle broadly rounded. Caudal not angular, vertebral axis slightly rising backward; subcaudal portion of moderate depth, not produced in a lobe, separated from the terminal by a shallow notch. Scales uniform, small, carinate, ending in a sharp point, becoming rough in old individuals. The scale crowns appear quadrangular; they have a strong median keel, also outer keels near the edge which converge and unite at the angles. Some scales are short and broad; on these the keel is shortened in some cases to a mere tubercle.

Total length 22, snout to vent $13\frac{1}{2}$, snout to dorsal $7\frac{1}{2}$, snout to pectorals $4\frac{1}{2}$, snout to mouth $1\frac{3}{8}$, and caudal $5\frac{3}{4}$ inches.

Mediterranean; Atlantic.

Isistius.

Scymnus Quoy & Gaimard, 1824, Voy. Uran., Poiss., p. 198 (part).
Leius Kner, 1865, Denk. Akad. wiss. Wien, **24**, p. 10 (non Leia Meigen, 1818).
Isistius Gill, 1865, Proc. acad. nat. sci. Phil., p. 264.

Body long, fusiform; tail short. Head subconical. Nostrils anterior; nasal valve with a short process in the middle. No nictitating folds. Spiracles

transverse. Mouth transverse, with a straight deep groove, covering the labial folds, at each angle, ending at the end of a transverse fold in front of and covering a distinct upper lip. Upper teeth raptorial, slender, subconical; lower sectorial, compressed, with a smooth-edged triangular cusp, erect. Gill openings narrow. Pectorals, dorsals, and ventrals small, caudal short. Tail without lateral folds or caudal pits. Scales minute, polygonal or quadrangular with a central depression on the crown, in pavement.

Isistius brasiliensis.

Scymnus brasiliensis Quoy & Gaimard, 1824, Voy. Uran., Poiss., p. 198.
Squalus (Scymnus) fulgens F. D. Bennett, 1840, Narrative whaling voyage, **2**, p. 255; G. Bennett, 1860, Gatherings nat. Australasia, p. 66.
Scymnus (Scymnus) brasiliensis Müller & Henle, 1841, Plagios., p. 92; Duméril, 1865, Elasm., p. 453.
Scymnus (Scymnus) brasiliensis var. *torquatus* Müller & Henle, 1841, loc. cit.
Scymnus (Scymnus) brasiliensis var. *unicolor* Müller & Henle, 1841, loc. cit.
Dalatias brasiliensis Gray, 1851, Chondropterygii, p. 76.
Leius ferox Kner, 1865, Denk. Akad. wiss. Wien, **24**, p. 10, pl. 4, f. 2.
Isistius brasiliensis Gill, 1865, Proc. Acad. nat. sci. Phil., p. 264; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 429; Peters, 1876, Monats. Berl. akad., p. 853; Garman, 1899, Mem. M. C. Z., **24**, p. 34, pl. 1, f. 1, pl. 2–3, pl. 69, f. 2.
Leius brasiliensis Günth., 1910, Südsee fische, **3**, p. 490.

Body cavity about two thirds and caudal fin about one sixth of the total length. Head subconic, crown somewhat flattened; nostrils in front, valve with a short sharp process in the middle. Eye large, orbit with an angle in the hind border. Mouth moderate, transverse, with a deep groove at each angle, with labial folds, and with distinct upper lip. Teeth dissimilar, smooth-edged; upper in 33 rows, slender, pointed, more or less oblique and moveable, several series in function; lower broad, with erect triangular cusp, in 31 rows, a single series in function, except when the outer is about to be dropped. Spiracle large, behind the eye about one length of the orbit, at a higher level, opening upward. Gill openings small, narrower than the spiracle, rather above the level of the pectorals. Pectorals small, subtruncate, angles rounded. First dorsal very small, end of base above origins of ventrals, hind margin truncate. Second dorsal little larger than the first, end of base near the middle of the space between the bases of the ventrals and the base of the caudal, fin triangular. Depth of caudal about equal its length, subcaudal portion produced in a lobe longer than the balance of the fin anterior to the shallow notch separating it from the terminal. The lateral folds said to occur on the tail were caused by contraction of the tissues in preservation. Total length 20, snout to vent $13\frac{1}{2}$, snout to dorsal 12, snout to pectorals $3\frac{3}{4}$, snout to mouth $1\frac{1}{4}$ and caudal fin $3\frac{1}{4}$ inches.

Brown, light to dark, with a darker band around the neck, across the gill openings: lower surfaces lighter to white, excepting perhaps the blackish collar on the neck, the lower surfaces of body, head, pectorals, ventrals, and caudal are luminous in life.

Tropical and temperate seas.

Heteroscymnus.

Heteroscymnus Tanaka, 1912, Fishes of Japan, 6, p. 104.

Body long, somewhat compressed; head depressed; tail short. Snout pointed, nostrils near the end. Mouth nearly transverse, with a deep groove at each angle. Teeth unlike: upper lanceolate, numerous; lower larger, compressed, with an oblique triangular cusp. Gill openings moderate, in front of the pectorals. Eyes small, without a nictitating membrane. Fins rather small; no spine in front of dorsals; first dorsal above the postpectoral space; no anal fin; caudals short and deep, no caudal pit. Scales of shagreen minute.

Heteroscymnus longus.

Heteroscymnus longus Tanaka, 1912, Fishes Japan, 6, p. 102, pl. 26.

Subfusiform, head depressed, body compressed, caudal pedicel slightly depressed. Body cavity about two thirds of the total length, head nearly one fifth. Snout less than one third of the head, depressed and broadly blunted across the end. Nostrils oblique, entirely in the forward half of the snout. Eye small, diameter nearly one tenth of the distance from the snout to the first gill opening; no nictitating membrane. Mouth inferior, below the eye, slightly arched forward, with a deep straight groove across each angle extending backward nearly one third of the distance to the gill opening. Upper teeth raptorial, many, lanceolate, functioning in several series; lower much larger, compressed, sectorial, non serrated, functional in two series, of eighteen teeth each (the outer series acting more as supports or braces to the inner, and on the way to be dropped), each tooth with a triangular, oblique cusp, outward directed from a notch in the outer edge. No median tooth on the lower jaws. Spiracle small, oval, behind the eye and at a higher level, its distance from the orbit nearly equal to that between nostrils and orbit or nostrils and mouth. Dorsals, pectorals, and ventrals small; dorsals with hinder angle produced; hind margin of first dorsal and subcaudal concave; origin of first dorsal little nearer to origins of pectorals than to those of the ventrals; origin of second dorsal above ends of bases of ventrals,

fin reaching a vertical from the origin of the subcaudal; caudals about as deep as long; subcaudal lobe nearly as deep as long, reaching a notch in front of the terminal; pectorals little longer than wide.

Total length 53.54 inches (136 cm.) of which the tail from the vent is one third; head or depth equal three sixteenths of the length to base of supracaudal; eye nearly one tenth, and snout to eye about two fifths of the head in front of the gill opening.

Brown; edges of fins darker.

Sagami Sea, Japan.

Somniosus.

Somniosus Lesueur, 1818, Journ. Acad. nat. sci. Phil., **1**, p. 222.
Laemargus Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 116.
Scymnus (*Laemargus*) Müller & Henle, 1841, Plagios., p. 93.
Rhinoscymnus & Somniosus Gill, 1864, Proc. Acad. nat. sci. Phil., p. 264.

Snout moderate, nostrils near the end. Caudal short and deep, other fins small; the two dorsals without a fin spine; no anal fin. Mouth transverse, with a deep straight groove across each angle, and with labial folds. Upper teeth pointed, raptorial, several series in function, lower broader, sectorial with the cusp directed obliquely outward, presenting the inner edge of each tooth toward the upper teeth, and with a notch on the outer edge at the base. Spiracles medium, behind the eye and slightly above its level. Tubercles small, uniform. Gill openings narrow, hardly extending above the level of the pectorals. Two species known, from the Arctic and North temperate seas.

Dorsal origin about midway from pectorals to ventrals near the middle of the total length . . . *brevipinna* (page 240)
Dorsal origin near the pectorals about midway from the end of the snout to the caudal fin . *microcephalus* (page 241)

Somniosus brevipinna.

Plate **15**, fig. 1–3.

Somniosus brevipinna Lesueur, 1818, Journ. Acad. nat. sci. Phil., **1**, p. 222, pl.; Bory, 1829, Dict. class. hist. nat., **15**, p. 597; Storer, 1839, Report fishes, p. 189.
Scymnus micropterus Valenciennes, 1832, Nouv. ann. mus., **1**, p. 454, pl. 20.
Scymnus brevipinna De Kay, 1842, N. Y. fish., p. 361, pl. 61, f. 202; Storer, 1867, Mass. fish, p. 259, pl. 38, f. 2.
Leiodon echinatum Wood, 1846, Proc. Bost. soc. nat. hist., **2**, p. 174.
Laemargus brevipinna Moreau, 1881, Poiss. France, **1**, p. 361.
Laemargus rostratus Helbing, 1904, Nova acta K. Leop.-Carol. akad. naturf., **82**, pl. 9, f. A.
Somniosus microcephalus Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 54.

Body little compressed, head depressed. Middle of the total length below the anterior portion of the first dorsal. Middle of the trunk, without the caudal, at the end of the pectorals. Tail from the vent less than one third of the total length. Snout hardly longer than width of mouth, blunt, rounded at the end; nostrils much nearer to the end than to the eyes. The length of the snout about equal to half the distance from the bases of the pectorals to the origin of the first dorsal, or to half that between the two dorsals, and to a little more than that between the base of the second dorsal and the caudal. Eye small, diameter nearly one fifth the length of the snout, or more than half the distance from the spiracle. Teeth in $\frac{70}{54}$ rows; upper more compressed and broader than those of *S. microcephalus;* lower, compared with those of the same species, a trifle narrow with slender elongate roots, Plate **15**, fig. 2, 5. Gill openings rather narrow, upper edges on a level with the pectorals. Pectorals small, angles rounded, fin reaching little more than half way from the base to the origin of the dorsal. Base of first dorsal above the mid length of the total, or one length of the snout behind the mid length of the trunk, excluding the caudal fins. Second dorsal origin above the ends of the bases of the ventrals. Ventrals larger than the dorsals, length of bases two thirds of their distance from the caudal. Caudal about one fifth of the total length, depth nearly two thirds of the caudal length, margins convex, except behind the subcaudal, which latter is deep anteriorly and is separated from the terminal by a shallow notch.

Blackish brown.

Total length of specimen described 76, snout to caudal 60, snout to ventrals 46, snout to dorsal 36, length of pectoral 8, and length of caudal 16 inches.

Sagami Sea, Japan. Alan Owston.

Somniosus microcephalus.

Plate **15**, fig. 4–6.

Haa-skierding Gunner, 1763, Trondj. sels. selskr., **2**, p. 330, pl. 10, 11.
Squalus carcharias Müller, 1776, Zool. Dan. Prodr., p. 38.
Squalus microcephalus Schneider, 1801, Bloch Ichth., p. 135.
Squalus borealis Scoresby, 1820, Arctic reg., **1**, p. 528, pl. 15, f. 3, 4.
Scymnus rostratus Risso, 1826, Hist. nat., **3**, Poissons, p. 138, pl. 3, f. 7.
Scymnus borealis Fleming, 1828, Brit. anim., p. 166.
Scymnus gunneri Thienemann, 1828, Lehrb., **3**, p. 409.
Scymnus glacialis F. Faber, 1829, Fische Islands, p. 23.
Squalus norvegianus Blainv., 1830, Poiss. Fr., p. 66.
Greenland shark Yarrell, 1836, Brit. fishes, **2**, p. 403; Couch, 1867, Brit. fishes, **1**, p. 57, pl. 13.
Squalus (Scymnus) gunneri Richardson, 1836, Fauna Bor. Amer., **3**, p. 313.
Scymnus (Laemargus) borealis Müller & Henle, 1841, Plagios., p. 93; Gaimard, 1851, Isl., Poiss., pl. 22; Duméril, 1865, Elasm., p. 455, pl. 5, f. 1, 2.

Scymnus (*Laemargus*) *rostratus* Müller & Henle, 1841, Plagios., p. 95; Duméril, 1865, Elasm., p. 458.
Dalatias (*Somniosus*) *rostratus* Gray, 1851, Chondropterygii, p. 77.
Dalatias (*Somniosus*) *borealis* Gray, 1851, ibid., p. 76.
Scymnus microcephalus Kröyer, 1853, Danm. fiske, **3**, p. 914; Malmgren, 1865, Oef. Svensk. vet. akad. Förh., p. 536; Jensen, 1907, Dan. fiske, p. 315, pl. 29, f. 2.
Squalus norvegicus Gray, 1854, Gron. syst., p. 8.
Somniosus microcephalus Gill, 1864, Proc. Acad. nat. sci. Phil., p. 264 name only; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 15; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 57; Jungersen, 1899, Dan. Ingolf exped., **2**, pt. 2.
Scymnus (*Laemargus*) *brevipinna* Duméril, 1865, Elasm., p. 456.
Laemargus borealis Günth., 1870, Cat. fishes Brit. mus., **8**, p. 426; Helbing, 1904, Nova acta K. Leop.-Carol. akad. naturf., **82**, pl. 9, f. B and text.
Laemargus rostratus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 427; Moreau, 1881, Poiss. France, **1**, p. 363; Doderlein, 1881, Man., **2**, p. 102.
Laemargus microcephalus Day, 1884, Brit. fishes, **2**, p. 320, pl. 162, f. 1.
Somniosus carcharias Garman, 1888, Bull. M. C. Z., **17**, p. 85, pl. 20.
Havkalen Jensen, 1907, Dan. fiske, p. 315.
Somniosus rostratus Regan, 1908, Ann. mag. nat. hist., ser. 8, **2**, p. 55.

Snout depressed, blunt, rounded at the end, length from the orbit about one half the distance between the eye and the third gill opening, or a little more than the width of the mouth. Middle of the total length behind the base of the first dorsal at the middle of the free extremity of that fin. Tail from the vent about one third of the total length. Nostrils small, near the end of the snout. Eye small, length of orbit more than one fourth that of snout, equal to distance from the spiracle. Gill openings somewhat narrow, upper angles in front of the pectorals. Origin of first dorsal midway from snout to caudal; base equal in length to snout, or to distance behind the bases of the pectorals, equal to less than one third of the length of the interdorsal space, to about two thirds of the distance between the base of the second dorsal and the caudal, or to the length of the ventral bases. Second dorsal smaller than the first, base equal to about half the distance from the caudal, origin above the ends of the ventral bases. Caudal one fifth of the total, angles not rounded, hind margin of subcaudal deeply and of terminal slightly concave. Intestine of specimen studied with thirty-three turns in the spiral.

Total length 106, snout to caudal 84, snout to pectorals $25\frac{1}{2}$, snout to mouth $8\frac{1}{2}$, snout to nostrils $2\frac{1}{2}$, and length of caudal 21 inches.

Blackish brown.

Specimen described from Provincetown, Mass.

Echinorhinidae.

Body massive, subfusiform. Head depressed. Snout broad, tapering. Eyes without a nictitating fold. Mouth crescentic, with labial folds. Teeth sectorial, similar in the two jaws, cusps oblique, notched at each side at the base.

Spiracles small. Two small dorsals, without a spine, above the tail. No anal fin. Dermal armature with scattered tubercles like those of certain Platosomia.

Echinorhinus.

Echinorhinus Blainv., 1816, Bull. Soc. philom., p. 121.
Scymnus Cuv., 1817, Reg. anim., **2**, p. 131 (part).
Goniodus Agass., 1835, Rech. poiss. foss., **3**, pl. E.

Body longer than the tail, subfusiform. Head depressed; snout tapering, nostrils nearly midway from the mouth. Mouth wide, arched forward, with deep labial folds around the angles. No nictitating membrane. Spiracles minute. Gill openings five, hindmost in front of the pectoral. Two dorsals, close together, behind the middle of the total length, without a spine. Teeth sectorial, smooth-edged, alike in the two jaws, broad, compressed, with cusp directed toward the angles of the mouth, and with a denticle or more at each side of the base. Skin with scattered tubercles or bucklers. Tail short, without caudal pits or lateral folds. Several species occur in the Tertiary.

Echinorhinus brucus.

Le bouclé Broussonet, 1780, Mém. Acad. roy., p. 672; Lacépède, 1798, Poissons, **1**, p. 283, pl. 3, f. 2.
Squalus brucus Bonnaterre, 1788, Ichth., p. 11.
Squalus spinosus Gmelin, 1789, Linné Syst., **1**, p. 1500; Schneider, 1801, Bloch Ichth., p. 136; Risso, 1810, Ichth. Nice, p. 42.
Echinorhinus spinosus Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 66; Strickland, 1840, Ann. nat. hist., **4**, p. 315; Bonaparte, 1841, Icon. fauna Ital., Pesci, pl. 55; Müller & Henle, 1841, Plagios., p. 96, pl. 60; Hamilton, 1843, Brit. fishes, **2**, p. 317; Cocks, 1850, Ann. nat. hist., **5**, p. 71; Gray, 1851, Chondropterygii, p. 78; Costa, 1857, Fauna Nap., Chondrop., pl. 16, 17; Duméril, 1865, Elasm., p. 459; Bocage & Capello, 1866, Plagios., p. 35; Capello, 1870, Jor. Acad. sci. Lisboa, **2**, p. 148; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 428; Canestrini, 1872, Ital. pesci, p. 42; Moreau, 1881, Poiss. France, **1**, p. 365, f. 64, 65; Perugia, 1881, Pesci Adriatico, p. 57; Doderlein, 1881, Man. ittiol. Medit., **2**, p. 104; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 14; Day, 1884, Brit. fishes, **2**, p. 323; McCoy, 1887, Zool. Vict., **2**, pl. 144; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 58; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 7, pl. 3, f. 8.
Scymnus spinosus Cuv., 1817, Reg. anim., **2**, p. 131; Risso, 1826, Hist. nat., **3**, Poissons, p. 136; Cloquet, 1826, Dict., **25**, p. 434, pl. 28, f. 2.
Spinous shark Yarrell, 1839, Brit. fishes, suppl., p. 54; Couch, 1867, Brit. fishes, **1**, p. 54, pl. 12.
Echinorhinus obesus A. Smith, 1849, Afr. Pisces, pl. 1.

Body elongate, slender to massive. Snout short, tapering from the eyes, rounded at the end; nostrils nearer to the mouth than to the end, valve with a pointed lobe in the middle. Mouth crescentic, width greater than length of snout, with labial folds around the angles. Teeth similar in the two jaws, in 20 rows, or more, compressed, sectorial, cusp with cutting edge inclined nearly to the horizontal and with one to two notches at each side of the base, one series in function, except about time of renewal, without or with a small erect median

tooth having a single denticle at each side of its base. Eye moderate, pupil erect. Spiracles small, a short distance behind the eye. Gill openings medium, anterior farther apart, hindmost widest, in front of the pectoral. Pectorals short, subtruncate, angles rounded. Dorsals and ventrals behind the mid total length; ventrals the larger. Dorsals small, rounded; first dorsal inserted above the middle of the bases of the ventrals; second little smaller than the first, similar in shape, behind the ventrals, not reaching the caudal. Caudal about one fourth of the total length, vertebral axis rising backward. Subcaudal fin rather deep, without a distinct lobe, concave on the hind margin, separated from the terminal by a shallow notch,— not always present; terminal pointed. Bucklers scattered, irregular, radiate based, surmounted by a sharp spine. Said to reach a length of nine feet or more.

Back brown, tinted with purple or violet, with or without blotches of darker; lower surfaces lighter to white.

Tropical and temperate Atlantic and Pacific; Mediterranean; Australia.

Pristiophoridae.

This family contains small sharks remotely allied to the Squalidae and distinguished from all others of the Antacea by the great depression of the head and the very long blade-like snout, supported by the greatly produced rostral and preorbital cartilages, at each edge of which there is a series of sharp teeth, in some degree resembling the saw on the species of Pristis of the Platosomia.

A barbel below each side of the lamina at some distance in front of the nostrils. Nostrils inferior. Mouth below the head, behind the eyes; a rudimentary labial fold at the angles on the lower jaws; teeth small, numerous, a number of series in function at once. Eyes superior, elongate, with lateral outlook; no nictitating membrane. Gill apertures lateral, in front of the pectorals. Spiracles rather large, behind the eye. Dorsal fins well developed, anterior above the body, posterior above the tail, not preceded by spines. No anal fin. Tail with a dermal fold at the lower edge of each side. Subcaudal fin reduced, separated from the tip by a notch; supracaudal fin broader backward.

The genera included in the Pristiophoridae are so closely related that there is little beside the number of gill openings to separate them.

Gill openings five . . . . . *Pristiophorus* (page 245)
Gill openings six . . . . . *Pliotrema* (page 248)

Pristiophorus.

Pristiophorus Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 116; Wiegm. arch., **1**, p. 399; 1838, Charlesworth's mag., **2**, p. 89; 1841, Plagios., p. 98.

Body elongate, tapering to head and tail, flattened in the head and below the tail. Eyes large, in front of the mouth. Pectorals broad, free from the head. Dorsals subequal, hinder angles produced. Ventrals small, margins oblique. Excepting in the five gill openings the characters of the genus are those of the family. The long rostral barbel and its position can be used in determining species from individuals of like sizes; but proportionally the barbel is longer and the snout shorter in the young which brings barbel, nostrils, and mouth nearer to one another and introduces a source of error in comparisons of specimens of different sizes.

Dorsals and pectorals entirely covered with scales
42 rows of teeth in the upper jaw . . . . *cirratus* (page 245)
Dorsals and pectorals nearly covered with scales
46–58 rows of teeth in the upper jaw . . . *japonicus* (page 246)
Dorsals and pectorals nearly naked
35–39 rows of teeth in the upper jaws . . . *nudipinnis* (page 247)

Pristiophorus cirratus.

Pristis cirratus Latham, 1794, Trans. Linn. soc. London, **2**, p. 281, t. 26, f. 5, t. 27; Schneider, 1801, Bloch Ichth., p. 351, pl. 70, f. 2.
Squalus anisodon Lacépède, 1802, Poissons, **4**, p. 680.
Squalus tentaculatus Shaw, 1804, Zool., **5**, p. 359; Nat. misc., **15**, pl. 630.
Pristiophorus cirratus Müller & Henle, 1841, Plagios., p. 98; Duméril, 1865, Elasm., p. 461; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 432; Ogilby, 1888, Cat., p. 13; 1889, Proc. Linn. soc. N. S. W., ser. 2, **4**, p. 186; Waite, 1899, Mem. Austr. mus., **4**, p. 37; 1904, Mem. N. S. Wales nat. club, no. 2, p. 9.

Closely allied to *P. japonicus*.

The species of this genus are much alike in general features. In this, as in all the others of the family, the body is elongate subfusiform and tapers from about the middle toward each end. The head is greatly depressed; the rostral lamina is broad at the cranium and tapers forward quite regularly and is armed on each edge by slender compressed very irregular teeth. The irregularity of the rostral teeth is less noticeable in early stages, when first appearing; on large specimens there are from one to four or more small teeth between two of the large. On the jaws the teeth are small, in 42 rows on the upper jaw in specimens

of three feet in length, the crowns are broad and each has a slender, narrow, pointed cusp. On this individual the distance between the nostril and the barbel about equals that between the nostril and the third or the fourth gill opening.

Pectorals short, broad; dorsals subequal; subcaudal, narrow, tapering toward each end, separated from the tip by a shallow notch; supracaudal wider, widening backward. Scales entirely covering dorsals and pectorals, minute, with a median keel.

Waite mentions a specimen measuring fifty inches, which is probably large for the species.

Eastern Australia, New South Wales; Tasmania.

Pristiophorus oweni of Günther differs from *P. cirratus* in having regular teeth on the rostral edges. It was only thirteen inches in length, which may account for the regularity in size of teeth.

Pristiophorus japonicus.

Plate **52**, fig. 3, (pelvis); Plate **56**, fig. 6, (heart); Plate **58**, fig. 5, (intestine); Plate **64**, fig. 1, (head & skeleton).

Pristiophorus cirratus Richardson, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 317 part; Schlegel, 1850, Jap. Pisces, p. 305, pl. 137; Bleeker, 1854, Verh. Bat. gen., **26**, p. 128.
Pristiophorus japonicus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 432; Ishikawa & Matsuura, 1897, Cat. fishes, p. 61; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 639.

Body elongate, tapering from near mid length to end of snout and tail; lower surface flattened, with a strong dermal ridge on each side from ventrals to caudal, caudal axis slightly raised. Head depressed, snout a long lamina with irregular sharp teeth on each edge. Eye large, elongate, superior with lateral outlook, forward of the mouth; orbit elliptical. Spiracle large, oblique, upper end close to the eye. Barbel less than half way from mouth to end of snout, flattened, reaching the nostril. Nostril in front of the eye, about one fourth of the distance from mouth to barbel. Mouth wide, with a rudimentary labial fold at the angle on the lower jaw. Teeth small in forty-six rows (46–58) on the upper jaws and thirty-eight or more on the lower; crown broad, with a sharp slender cusp. Gill openings moderate, width equal that of spiracle or two thirds the length of the orbit, in front of the pectorals. Pectorals large, subtruncate, broader than long. Dorsals smaller than pectorals, equal, hinder angles produced; origin of first one and one-half times the length of the base in front of that of the ventrals. Ventrals smaller than dorsals, outer margins somewhat

oblique, origins below erect portion of hind border of first dorsal. Subcaudal reduced, narrow, separated from the tip by a notch; supracaudal wider, widening backward; tip broad. Scales minute, with a strong median keel, irregular, point projecting.

Olivaceous brown on the back; whitish beneath, on the foramen in front of the skull, in a narrow band near each edge of the rostrum, and in another along each flank. At each side of the white bands on the rostrum the color is darker brown causing the appearance of four longitudinal bands of the dark color.

The following measurements taken from the specimen described above, No. 1045, M. C. Z., from Yenoura, Japan, compared with those from a much smaller one will indicate the course of changes in the individual at various ages:— Total length 34 inches, snout to barbel $5\frac{1}{2}$, snout to nostrils $8\frac{3}{4}$, snout to eyes 9, snout to mouth 10, snout to first dorsal $16\frac{1}{2}$, and length of caudal $5\frac{3}{4}$ inches. The distance between nostril and barbel = distance between nostril and second gill opening.

The total length of No. 1283 is 12 inches; snout to barbel $1\frac{5}{8}$, snout to nostrils $2\frac{1}{2}$, snout to eyes $2\frac{11}{16}$, snout to mouth $3\frac{3}{16}$, snout to first dorsal $5\frac{3}{4}$; length of caudal $2\frac{5}{16}$ inches. The distance between nostril and barbel = $\frac{2}{3}$ distance between the nostril and the second gill opening. Barbel half way from mouth to end of snout, reaching the angle of the mouth. Color light reddish brown, with light as in the larger examples.

Among the more noticeable proportional changes occurring during growth would appear to be lengthening the rostrum, shortening the barbel, and increasing the distance between nostril and barbel.

Pristiophorus nudipinnis.

Pristiophorus nudipinnis Günth., 1870, Cat. fishes Brit. mus., **8**, p. 432; Castelnau, 1872, Proc. Zool. & acclim. soc. Victoria, **1**, p. 220; McCoy, 1881, Zool. Vict., **1**, pl. 56, f. 2; Ogilby, 1889, Proc. Linn. soc. N. S. W., ser. 2, **4**, p. 186.

Body elongate, subfusiform. Rostral lamina near one fifth of the total length (in a specimen three feet long), teeth very unequal. Barbels less than half way from the angle of the mouth to the end of the snout, their length equal two thirds of their distance from the mouth, reaching the nostril. Teeth small, in thirty-five rows on the upper jaws, thirty-two on the lower; crown broad, with a strong narrow median cusp. Scales minute, crown with three keels (3–7) on the forward half, smooth posteriorly; scales absent from the marginal portions of dorsals and pectorals. Hind margins of fins slightly concave;

pectorals large, broad; first dorsal entirely forward of the origins of the ventrals, and second dorsal one length of its base behind their tips. Subcaudal narrow, narrowing toward each end, separated from the tip by a shallow notch; supracaudal wider, broadening backward; tip of moderate width.

Brown, lighter beneath, rostrum longitudinally striped with brown and light.

Melbourne, Hobson's Bay; Tasmania.

Pliotrema.

Pliotrema Regan, 1906, Ann. Natal mus., **1**, p. 1, pl. 1.

This genus has six gill clefts on each side. Aside from these there appears very little to separate it from Pristiophorus. Whether this number of clefts has been continuously retained from a six-gilled ancestry or has been secured by specialization, or by reversion, from five-gilled ancestors is not yet determined. It is certain, however, that its possession in connection with the general structure and affinities gives us no reason for placing the family any nearer to the Hexanchoids.

Pliotrema warreni.

Pliotrema warreni Regan, 1906, Ann. Natal mus. **1**, p. 1, pl. 1.

Body elongate, width and depth about equal, flattened beneath and bearing a well-developed dermal ridge at the lower edge of each side on the tail. Scales small, with a median keel and with or without a lateral keel at each side of it, absent from distal portions of the fins. Snout length four and two fifths times its greatest width. Rostral teeth compressed pointed unequal, larger denticulate on the hinder margin. Nostril reached by the barbel, further from its root than from the angle of the mouth. Forty to forty-four rows of teeth on the upper jaws, thirty-one to thirty-four on the lower. Dorsals subequal, origin of first above hind extremity of the pectoral. Caudal feebly heterocercal, upper lobe well developed. About 750 mm. in total length.

The coast of Natal and from False Bay, Cape of Good Hope, in about forty fathoms.

Rhinidae.

The Rhinidae are small sharks of the sands and the rocks of the sea bottom with habits like those of some Batoids, which have modified themselves in structures and shapes in similar directions. They possess some features evidently

derived from a common ancestral line nearer than that of most sharks to the Platosomia, but the affinities are not very close. The common shape of members of this family is that seen in fig. 1 of Plate 16. The entire form has been much depressed and broadened; the pectorals, without being joined to the sides of the head, have expanded forward and backward, and the dorsals, reduced in size, are placed on the tail on which also supracaudal and subcaudal have become modified. Branchial cartilages, shoulder girdle, and pelvis have lengthened and strengthened and the dermal armature has undergone changes for special protection demanded by habits of life. The gills are lateral, in front of the pectoral fins, as in all Antacea. Of the dentition each tooth has a broad backward extended base anteriorly on which rises an acute rather narrow somewhat compressed cusp with a sharp ridge on each side, continued to the edge of the base and with an extension downward below the cone in front and another backward behind it. There are generally no median teeth on the symphysis. There are about twenty rows of teeth on each jaw of which three or four series are in function. The scales vary greatly on the individual at different ages and on different parts of the body. The pattern, best seen on the young, includes a broad base, somewhat stellate in cases, from which rises a slender hooked cusp, conical in the distal portion and ridged with four keels or more on the basal section. Two keels extend down in front, with rarely a smaller median between, and a stronger one passes down at each side; these again may be followed by one or more. On some examples the keel at each side is stronger and reaches the outer edge while a similar one goes directly backward, an arrangement suggestive of the tooth pattern. At later stages the scales, especially along the middle of the back, become more placoid or tubercular, but on the edges of the fins and on the lower surfaces the crowns become leafshaped and imbricated. From the skull and the branchial skeleton there is no doubt the family is to be classed with the Antacea yet the affinities with the Rhinobatidae bring it closer than any other of the sharks to the Batoids. The approximation is particularly noticeable in the vertebral column, the neural spines, the calcification, the shoulder girdle, the pectoral fins, the pelvis, in the ventral fins, and in the dorsals. In both Rhina and Rhinobatus the dorsals are attached to modified neural spines, an arrangement not found in the most primitive of the other recent sharks. Rhina and Rhinobatus have like basalia in the dorsals and they have the same transverse dilatations of the upper end of the neural spine at the origin of each dorsal fin; in these respects both differ markedly from the Squalidae.

Various fossil species from the Jurassic and later belong to the only genus

of the family. Some of them, as *Rhina alifera* Münster, do not differ greatly from recent species; others, as *Rhina speciosa* Meyer, have bodies that are more slender and tails that are longer, thus approaching more closely the shape of most living sharks.

Rhina.

Rhina (Aristotle) Klein, 1742, Hist. pisc., miss., **3**, p. 13; 1776, Neuer schaupl., **2**, p. 587; Walbaum, 1792, Artedi, p. 580; Rafinesque, 1810, Caratteri, p. 14; Ind. itt. Sic., p. 45.
Squatina Valmont, 1768, Dict. d'hist. nat., **1**, p. 117; Duméril, 1806, Zool. anal., p. 102.

Body, head, and tail depressed and flattened. Head short, broad; mouth wide, anterior; nostrils anterior; a thin fold along each side from the nostril to the angle of the jaws; one labial fold on the upper jaw, two on the lower. Eyes small, superior; eyeball free from the edge of the orbit. Spiracles behind the eyes. Gill openings five, lateral, crowded together, in front of the pectoral. Pectorals broad, extended forward, free from the head. Dorsals small, on the tail, not preceded by spines. No anal fin. Caudal axis not raised; supracaudal fin shorter, more erect; subcaudal widening backward. Three strong labial cartilages, joined, to form the angle of the mouth, at a distance from the angle of the jaws. Anterior nasal valve with two cirri and more or less fringed in the young. Pterygoquadrate with a long flexible process through the orbital region and the top of the skull. Hyomandibular and branchial cartilages strong, flattened. Pelvis curved backward in the middle and with a short process extended forward from each end, as in the Rhinobatidae and some other Batoids. A blunt keel on each side of the tail, posteriorly.

The species differ in regard to the pterygoquadrate process:— in *R. squatina* the postorbital process unites with the skull in front of the foramen, thus completing the latter, but in *R. philippi* and *R. californica* there is no such union and the foramen remains open toward the orbit.

Because of individual variations in the tubercles of the back, in the point of origin of the first dorsal in relation to the extremities of the ventral fins, and in the fringes of the nasal valves, they have not been used in distinguishing the species. Dependence has been placed rather on the shape of the caudal fin, the angle formed by the meeting of a line along the outer edge of the pectoral with another across the hind margin of that fin, the condition of the fold along the side of the head, and the completeness of the foramina for the processes of the pterygoquadrates in the top of the skull.

Temperate and tropical seas.

Subcaudal pointed
- margins of the pectoral forming a right angle
  - fold at the corner of the mouth angular, prominent
    - foramina complete . . . . . *squatina* (page 251)
  - margins of pectoral forming little more than a right angle
    - fold at corner of mouth not prominent . . *dumeril* (page 252)
  - margins of pectoral much curved . . . . *armata* (page 253)

Subcaudal rounded
- margins of pectoral forming more than a right angle
  - fold at corner of mouth expanded, convex
    - foramina open toward the eye . . *californica* (page 253)

Subcaudal obliquely truncate
- margins of pectoral forming a right angle
  - fold at corner of mouth slightly expanded
    - foramina very incomplete . . . *philippi* (page 254)
- margins of pectoral forming little more than a right angle
  - fold lobed at the nostril, hardly at corner of mouth
    - foramina complete . . . . . *australis* (page 255)

Subcaudal truncate
- margins of pectoral forming more than a right angle
  - fold lobed at corner of mouth, expanded at angle of jaws
    - spiracles farther apart than the eyes . *japonica* (page 255)
- margins of pectorals forming much more than a right angle
  - fold lobed at corner of mouth
    - spiracles closer together than the eyes . *nebulosa* (page 256)

Rhina squatina.

Πίνη Aristotle, Hist. An., II, C. 11, V, C. 4, VI, C. 10, IX, C. 25.

Squatina Wotton, 1552, Diff. anim., f. 144 E; Belon, 1553, Aquat., p. 77; Rondelet, 1554, Pisc., p. 367; Salviani, 1554, Aquat., f. 151, 152; Gesner, 1558, Aquat., p. 1059; Aldrovandi, 1613, Pisc. & Cet., p. 472; Jonst., 1649, Pisc., p. 39, pl. 11, f. 7; Willughby, 1686, Pisc., p. 79, pl. D3; Duhamel, 1782, Traité, **4**, p. 291.

Squalus squatina Linné, 1758, Syst., **1**, p. 233; 1766, Syst., **1**, p. 398; Brünnich, 1768, Ichthy. Massiliensis, p. 5; Bloch, 1785, Ausl. fische, **1**, p. 25; Bonnaterre, 1788, Ichth., p. 12, pl. 5, f. 14; Schneider, 1801, Bloch Ichth., p. 137; Turton, 1807, Fauna, p. 114; Donovan, 1808, Brit. fish., pl. 17.

Monk or *Angel fish* Brookes, 1763, Nat. hist., **3**, p. 41.

Angel fish Pennant, 1769, Zool., **3**, p. 74.

Rhina squatina Klein, 1776, Neuer schaupl., **2**, p. 589; Walbaum, 1792, Artedi, p. 580; Rafinesque, 1810, Carratteri, p. 14; Ind. itt. Sic., p. 45; Duméril, 1865, Elasm., p. 464, pl. 5, f. 5.

L'ange Broussonet, 1780, Mém. Acad. roy., p. 679.

Le squale ange Lacépède, 1798, Poissons, **1**, p. 293, pl. 12, f. 3; Shaw, 1810, Nat. misc., pl. 906.

Squatina vulgaris Risso, 1810, Ichth. Nice, p. 45; Fleming, 1828, Brit. anim., p. 169; Müller & Henle, 1841, Plagios., p. 99, pl. 35, f. 4; Kröyer, 1853, Danm. fiske, **3**, p. 935.
Squatina angelus Blainv., 1816, Bull. Soc. philom., p. 121; 1830, Poiss. Fr., p. 53; Risso, 1826, Hist. nat., **3**, Poissons, p. 139; Jenyns, 1835, Man., p. 507; Yarrell, 1836, Brit. fishes, **2**, p. 407; Parnell, 1838, Mem. Wern. soc., **7**, p. 421; Bonaparte, 1841, Icon. Fauna Ital., Pesci; Gray, 1854, Gron. syst., p. 14.
Squatina laevis Cuvier, 1817, Reg. anim., **2**, p. 131.
Squatina lewis Couch, 1825, Trans. Linn. soc., **14**, p. 90; Jenyns, 1835, Man., p. 508.
Squatina aculeata Cuvier, 1829, Reg. anim., **2**, p. 394.
Squatina fimbriata Müller & Henle, 1841, Plagios., p. 101, 192, pl. 35, f. 5.
Squatina oculata Bonaparte, 1841, Icon. Fauna Ital., Pesci.
Monk fish, Couch, 1865, Brit. fishes, **1**, p. 73, pl. 17.
Rhina (*Squatina*) *aculeata* Duméril, 1865, Elasm., p. 465.

Nasal valves somewhat fringed in young specimens, more simple in the old ones; inner cirrus slender, pointed, outer weakly bilobed or simple. Spiracles farther apart than the eye openings. Fold along the side of the head widening toward the angle of the jaws, with a subangular lobe opposite the corner of the mouth. Teeth $\frac{20}{20}$, no median symphyseal teeth. Outer margin of pectoral nearly straight, meeting a line across the end of the fin in a right angle, hind margin concave, angles less rounded than on other species. Outer edge of ventrals sinuous, outer angles blunted. Supracaudal nearly erect; subcaudal longer, pointed. More often there is no dorsal series of enlarged tubercles. Scales varying greatly on different parts of the body; on the young the cusp is slender and has the two keels in front with others at each side of the basal portion; in later stages the front two of the keels may unite into one and the base become more discoid as the tubercular forms appear. The postorbital process meets the top of the skull in front of the suborbital process of the pterygoquadrate and forms a complete foramen.

Greyish to reddish brown thickly sprinkled with dots and spots of darker. In cases with larger spots of blackish posteriorly.

Eastern Atlantic and Mediterranean Sea.

Rhina dumeril.

Squatina dumeril Lesueur, 1818, Journ. Acad. nat. sci., Phil., **1**, p. 225, pl. 10.
Squatina dumerili DeKay, 1842, N. Y. fish., p. 363, pl. 62, f. 203; Leidy, 1847, Proc. Acad. nat. sci. Phil., **3**, p. 217.
Rhina dumerili Gill, 1861, Proc. Acad. nat. sci. Phil., p. 61 (name only); Duméril, 1865, Elasm., p. 467.

Nasal valves weakly fringed, cirri simple. Distance between the eyes nearly equal to that between the spiracles. Fold at the side of the head little wider posteriorly. Outer margin of the pectoral nearly straight, with a line across the end forming nearly a right angle, hind margin concave, inner angle broadly rounded. Both lobes of the caudal rather pointed.

The colors as given by Lesueur from a fresh specimen are bluish ash grey on head, back, fins, and tail with reddish tints upon the head and margins of the fins; abdomen white, with a remarkable reddish spot on the throat, another on the abdomen, and another behind the vent, extending to the end of the tail. The pectorals and ventrals are in like manner bordered with large and irregular bands of the same color.

A close ally of *R. squatina*.

Western Atlantic. Specimen in hand from Newport, R. I.

Rhina armata.

Rhina armata Philippi, 1887, Ann. Univ. Chile, **71**, E., p. 29, extra pl. 7, f. 1.

Little that will serve to establish this species can be drawn from either description or figure as published; for the time it must be considered doubtful. The spiracles appear to be much closer together than the eyes. The outer margins of the pectorals are much curved, more so than on any other known species, the outer angle is acute, and the fin is narrowed posteriorly. On the ventrals the anterior border is nearly straight, and both lobes of the caudal are acute. In these respects it agrees with neither of the known species from the Eastern Pacific.

The type was taken at Iquique, Chile; it bore a median row of tubercles on the back.

Rhina californica.

Plate **16**, figs. 1–4; Plate **61**, figs. 9–11.

Squatina californica Ayres, 1859, Proc. Cal. acad. sci., p. 29; 1860, ibid., fig. 7 (outlines).

Snout medium, rounded. Nasal valves not fringed; cirri simple, outer broader. Spiracles closer together than the eye openings. Fold at the side of the head a little wider opposite the corner of the mouth and again at the end opposite the angle of the jaws. Teeth $\frac{18}{18}$, on young individual, no teeth on the symphysis. Postorbital process not joined to the top of the skull in front of the suborbital process of the pterygoquadrate. Dorsals subtruncate, anterior little larger. Outer margin of the pectoral nearly straight; outer angle more than a right angle; hind margin little concave; inner margin broadly curved; posterior angle less than a right angle, blunted. Anterior border of ventrals convex, outer nearly straight. Caudal of medium size, supracaudal concave on the hind

margin, subcaudal rounded, not pointed. Scales on the young broad-based, with slender hooked cusps of which the distal portion is subconical and the basal section carinate. As in other species there are two keels in front and others at the sides. Larger scales to tubercles appear on the back; a median series above the vertebrae. On a specimen of more than thirteen inches the modification of the scales below the tail and edges of the paired fins is comparatively slight.

Rusty or reddish brown with numerous small spots of black, the larger symmetrically arranged, Plate 16, fig. 1. On a larger specimen the black spots are larger as compared with the others and more distinct.

California and Mexico.

Rhina philippi, sp. nov.

Snout broad, subtruncate. Nasal valves not fringed; cirri without lobes. Spiracles nearly as far apart as the eyes. Fold along the side of the head wider and convex opposite the corner of the mouth, not angled as in *R. squatina*, much narrower backward. Teeth in $\frac{20}{20}$ rows, no median teeth on the symphysis. Postorbital process of the skull widely separated from the top of the cranium in front of the suborbital process of the pterygoquadrate, leaving the foramen open toward the eye. Dorsals equal, anterior rather more pointed. Outer border of the pectoral nearly straight, slightly convex; outer angle little more than a right angle, inner angle very broadly rounded, inner margin broadly curved, posterior border nearly straight, slightly concave. Anterior edges of ventrals very convex, outer margin nearly straight. Caudal larger, and supracaudal broader than on either *R. squatina* or *R. californica;* subcaudal less pointed than that of the former and more truncate than that of the latter. Scales small, with irregular broadened base and slender hooked cusp, conical toward the summit and commonly bearing two keels in front and one to two or more at each side on the basal section. Below fins and tail, and on larger specimens more of the lower surfaces, the crowns are so modified, flattened, and smoothed as to appear imbricate. A few larger scales at the eyes and spiracles. No median row of large tubercles on the back.

Named in honor of Doctor Rodulfo A. Philippi.

The specimens described were secured at the Mexillones, by Captain W. H. A. Putnam.

Rhina australis.

Rhina squatina McCoy, 1879, Zool. Vict., **4**, pl. 34; Macleay, 1881, Proc. Linn. soc., N. S. Wales, **6**, p. 368; Johnston, 1883, Proc. Roy. soc. Tasmania, p. 139.
Squatina squatina Waite, 1899, Mem. Austr. mus., **4**, p. 37.
Squatina australis Regan, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 438.

Nasal valves and cirri fringed. Fold at the side of the head lobed behind the nostril, not as wide opposite the angle of the mouth, narrow posteriorly. Spiracles farther apart than the eyes. Teeth of a ten inch specimen in $\frac{20}{18}$ rows; no teeth on the symphysis. Outer margin of the pectoral meeting a line across the hind margin at much more than a right angle, posterior border concave, inner angle prominent, inner edge broadly curved. Forward margin of ventrals convex, outer sinuous. Dorsals equal, subtruncate, hind margins convex. Posterior margin of supracaudal sigmoid, very oblique; subcaudal longer, narrow, obliquely truncate. Postorbital process in contact with the top of the skull in front of the suborbital process of the pterygoquadrate, foramen complete. Scales subconical at the apex, carinate toward the base; commonly with two keels in front, in cases three, and one or more behind these at each side.

"Color: above sandy-brownish lilac, the ground color being darker, minutely mottled with very numerous, small, lighter spots, the spots on the fins and eyes being darker; pinkish-white below" (McCoy).

Off the coast of Victoria, Australia, the species reaches a length of five feet.

Rhina japonica.

Squatina vulgaris Müller & Henle, 1841, Plagios., pl. 35 (snout): Schlegel, 1850, Jap. Pisces, p. 305, pl. 136.
Squatina japonica Bleeker, 1857, Act. Soc. sci. Ind. Neerl., **3**, p. 40; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 641.
Rhina squatina Ishikawa & Matsuura, 1897, Cat. fishes, p. 61.

Nasal valves fringed; inner cirrus slender, simple, outer stronger lobed and fringed. Spiracles farther apart than the eyes. Fold at the side of the head with an elongate rounded expansion opposite the corner of the mouth, narrower opposite the angle of the jaws. Teeth of a seventeen inch specimen in $\frac{20}{20}$ rows, no teeth on the symphysis. Another individual, one of four, has a distinct row of teeth on the middle of the symphysis. Postorbital foramen completely enclosed. Outer border of the pectoral slightly convex, meeting a line across the hind border at more than a right angle, inner margin broadly curved, inner angle broadly rounded, outer angle blunted. Anterior margin of the ventrals

convex, outer border nearly straight. Dorsals about equal, rounded. A blunt keel at each side of the tail in front of the caudal. Caudal as broad as long; supracaudal rather broad, rounded; subcaudal vertically subtruncate, convex. Scales with slender hooked cusps and broad bases. The cusp is subconical at the apex and there are two keels in front of its basal portion and others at each side. The modifications are those common to species of the genus. A specimen of nine inches in length at the time of the loss of the yolk sac is naked; one of twelve inches has the back and the outer parts of the lower surface covered with scales and has a vertebral series of larger ones, besides a few others in groups at the eyes and spiracles. At seventeen inches the scales of the middle of the back are more placoid and larger and on the lower surfaces of the paired fins and the tail the smooth flat-crowned imbricate scales have spread toward the middle, which on still larger individuals is entirely covered with the exception of a space below the throat and gills.

Rusty to plumbeous brown thickly freckled with small spots to dots of darker. Belly white, borders of lower surface with leaden brown which spreads toward the middle. One example at hand has faint transverse bands of darker as wide as the dorsal on the back: one across the nape, two between the bases of the pectorals, three others between the ventrals and one in front of the first dorsal.

Japan.

Rhina nebulosa.

Squatina nebulosa Regan, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 439.

"Outer nasal flap with entire edges; inner flap with two nearly simple prolongations, the outer of which has a fringed lobe at its base." Folds at the side of the head forming two lobes with convex edges at each side, the second the larger opposite the angle of the mouth. Spiracles not quite so far apart as the eyes. Outer angle of the pectoral much more than a right angle. Ventrals extending beyond the origin of the first dorsal. Posterior edge of the supracaudal slightly emarginate; subcaudal nearly vertically truncate. "Upper surface with small pointed denticles, each with three keels; no median series of enlarged denticles; small imbricated denticles at outer edges of paired fins, extending on to their lower surface and on the pectorals forming a strip about equal in width to the distance between eye and spiracle; denticles on lower surface of tail not extending forward to its base; lower surface of head and abdomen naked. Brownish, obscurely marbled with blackish, and with a few small round whitish spots."

Evidently this form is very closely allied to *R. japonica*. Known from the description taken from a Japanese specimen of 580 mm.

PLATOSOMIA.

This division includes all of the Chondropterygia in which the body, head, and pectorals are depressed, broadened and joined as so to form a disk on which the eyes and the spiracles are superior and the nostrils, mouth, and gill openings inferior, and from which the tail is more or less distinct and bears upon its upper surface the dorsal fins, when present. The number of fins varies:—in many forms there are two dorsals, in some there is but one dorsal, and in others there are no dorsals; the caudal is present in many genera and absent in many others. An anal fin does not occur in the division. Throughout the pectorals are main factors in propulsion, but in certain groups they are greatly aided by a caudal. All Platosomia have the absorbent surfaces in the intestine much increased by means of spiral folds. The majority are ovoviviparous; the Raiidae are oviparous.

Body, including the head and the expanded pectorals, discoid. Eyes and spiracles superior. Mouth inferior, more or less protrusible. Gill openings inferior. Teeth in bands or pavements, compressed or cuspidate to broad and plate-like. Nasoral grooves present or absent. Electric organs absent or present. No anal fin. Tail short to long and whip-like; with or without dorsal fins, a caudal fin or a serrated caudal spine. Pectorals with elongate basal and numerous radial cartilages, extending forward above the gill openings.

Synopsis of Groups of Families.

Body and pectorals depressed to form a disk, narrow and elongate, short to broad; skull produced in a median rostral cartilage, long to short; tail strong, with two dorsals and a well-developed caudal; electric organs absent or incipient; copula of hypobranchial cartilages unsegmented; nasoral grooves, from nostrils to mouth, absent or incipient; teeth small, in pavement; pelvis transverse: *Rhinobatoidei* (page 258)

Pectorals including electric organs beside the body in a broad rounded disk; skull produced in a short stout branching median rostral cartilage; tail short, with two dorsals, one dorsal, or none, and a well-developed caudal; copula incomplete; nasoral grooves; teeth small, in bands, raptorial; pelvis arched backward, with lateral prepelvic processes: . . *Narcoidei* (page 259)

Pectorals and body broad, angular to rounded, without electric organs;

skull produced in a narrow pointed rostral cartilage that is rarely obsolete; tail moderate to slender, commonly with two small, rayed dorsals and with a more or less imperfect membranous caudal, without a serrated spine; copula unsegmented; nasoral grooves; teeth small, in pavement; pelvis transverse, with lateral prepelvic extensions: . . . . . *Raioidei* (page 259)

Pectorals and body broad, polygonal to rounded; skull not produced in a rostral cartilage; tail slender whip-like, with a serrated spine and with or without narrow membranous fins, or a rarely present rayed fin; copula segmented; nasoral grooves ; teeth small, in pavement; a median prepelvic process or spine: *Dasybatoidei* (page 259)

Pectorals and body in a broad polygonal disk; skull bearing cranial sections of the fins, not produced in a median rostral cartilage; nasoral grooves; copula imperfect; tail slender whip-like, with a serrated spine or rarely without; teeth broad, molarial; pelvis arched forward, with a median prepelvic process: *Myloidei* (page 259)

Pectorals and body broad massive angular; skull broad, preceded by lateral sections of the fins, without a produced median rostral cartilage; tail slender, whip-like; copula incomplete; teeth minute, in bands; pelvis arched forward, with a median prepelvic process: . . . . *Mobuloidei* (page 259)

Synopsis of Families.

Rhinobatoidei.

Disk small; rostrum produced, toothed on its edges; dorsals and caudal present
copula unsegmented; no electric battery; no nasoral grooves
pectorals not continued forward at the side of the head.
Pristidae (page 260)

Disk moderate; rostrum more or less produced, not toothed on its edges; dorsals and caudal present
copula unsegmented; no electric battery; no nasoral grooves
pectorals continued at side of head, not reaching end of snout
Rhinobatidae (page 266)

Disk large, broad, rounded; dorsals and caudal present
copula unsegmented, nasoral grooves rudimentary or absent
pectorals continued to end of snout; rostral cartilage short
Discobatidae (page 287)

NARCOIDEI.

Disk broad, including an electric battery at each side of head
copula incomplete; nasoral grooves present; pectorals widely separated
prepelvic processes lateral; rostral cartilages branching
Narcaciontidae (page 293)

RAIOIDEI.

Disk broad, not including an electric battery; nasoral grooves present
copula unsegmented; pectorals not meeting in front; no caudal spine
prepelvic processes lateral; rostral cartilage present or absent
Raiidae (page 316)

DASYBATOIDEI.

Disk broad; no electric organs; tail slender, with, or rarely without a spine
nasoral grooves
copula segmented; pectorals extended to end of snout; no median rostral cartilage
prepelvic process median, rudimentary . *Dasybatidae* (page 373)
copula segmented; pectorals reaching end of snout; no rostral cartilage
prepelvic process median, elongate; disk subcircular to elliptic
Potamotrygonidae (page 415)

MYLOIDEI.

Disk polygonal, pectorals broad angular; copula imperfect; no rostral cartilage
snout in a single lobe; teeth broad, molarial; nasoral grooves
prepelvic process median, rather short; pelvis arched; tail whip-like
Myliobatidae (page 427)
snout in two separate lobes; teeth molarial; tail whip-like, with a spine
prepelvic process median, rather short; pelvis greatly arched
Rhinopteridae (page 443)

MOBULOIDEI.

Disk polygonal; pectorals broad, angular; copula imperfect; no produced rostral cartilage
snout very broad, with two lateral lobes; teeth minute; tail whip-like
prepelvic process median, elongate; pelvis greatly arched
Mobulidae (page 448)

Pristidae.

In this family the Platosomia make their nearest approach to the Antacea. The elongate form and the comparative freedom of the head from the pectoral fins give an appearance of nearness to the sharks that loses significance as it is seen that in all essential features the Pristidae are more closely allied to the skates. By some authors the family is included in the Rhinobatidae. In the species of Pristis, now living, the body and tail are elongate, flattened on the lower surfaces, and the snout is produced as a long flat blade, on each edge of which is a series of strong teeth, supported by prolongation of the cartilages of the skull in three to five more or less calcified tubes. The gill openings are below the body. In the pectoral fins the propterygia are as well developed as the metapterygia; the fins are united to the head opposite the gills but do not extend to the snout. A single genus of half a dozen living species represents the family in recent times. With it have been placed the fossil genera Propristis Dames, 1883, from the Lower Tertiary of Egypt, in which the rostral tooth-bearing margin is dermal, and Sclerorhynchus Woodward, 1889, from the Upper Cretaceous of Mt. Lebanon, Syria, which genus has swollen-based teeth, more like the tubercles, on the edges of the rostral cartilages. Another genus of fossils, Amblypristis Dames, 1888, founded upon broad short rostral teeth from the Egyptian Eocene, is also said to belong here.

That the Pristidae dwell upon the bottom is evident from the fins, the pavement-like oral teeth, the size of the spiracle, the small gill openings, and the worn condition of the scales on the lower surfaces.

Pristis.

Pristis Klein, 1742, Hist. pisc., miss., **3**, p. 12; 1749, ibid., **5**, p. 78; 1779, Neuer schaupl., **7**, p. 403.

Rostral teeth firmly imbedded in the rostral cartilages, except in the very young. Mouth transverse; oral teeth small, in pavement, smooth, in many rows (70–178 or more) on the upper jaw. Edge of the orbit not free from the eye in its upper half, the lower half of the orbit serving as a nictitating membrane when the eye is retracted. Spiracles moderate, behind the eye. Gill openings ventral. Pectorals united to the head along the gills, not continued to the snout. Caudal axis slightly raised. Intestine with about eight turns in the spiral valve. Pelvis convex in front, without lateral processes directed forward from each end.

The less specialized of the species are those of which the rostra are broader and more tapering and of which the rostral teeth are fewer in number. A dozen or more of fossil species from the Lower Eocene and later, in Europe and America, have been described from detached rostral teeth, vertebrae, and other fragments.

Tropical and subtropical seas; some or all the species entering fresh waters.

Dorsal origin behind bases of ventrals
  subcaudal lobe prominent
    23–35 teeth on each edge of rostrum . . . *cuspidatus* (page 261)
Dorsal origin more than ½ length of base behind origins of ventrals
  subcaudal lobe absent
    25–32 teeth on each edge of rostrum
      second dorsal equal the first . . . *zysron* (page 262)
Dorsal origin opposite origins of ventrals
  subcaudal lobe absent
    24–32 teeth on each edge of rostrum
      second dorsal reaching the caudal . . *pectinatus* (page 262)
Dorsal origin ¼ length of base behind origins of ventrals
  subcaudal lobe absent
    21 teeth on each edge of rostrum
      second dorsal smaller . . . . . *clavata* (page 263)
Dorsal origin opposite origins of ventrals
  subcaudal lobe absent
    16–20 teeth on each edge of rostrum
      second dorsal about equal first . . . *pristis* (page 264)
Dorsal origin in advance of origins of ventrals
  subcaudal lobe small
    17–22 teeth on each edge of rostrum
      second dorsal smaller . . . . . *microdon* (page 265)

Pristis cuspidatus.

Pristis cuspidatus Latham, 1794, Trans. Linn. soc. London, **2**, p. 279, pl. 26, f. 3; Schneider, 1801, Bloch Ichth., p. 351; Müller & Henle, 1841, Plagios., p. 107; Duméril, 1865, Elasm., p. 476; Day, 1878, Ind. fishes, p. 728, pl. 191, f. 3; Annandale, 1909, Mem. Ind. mus., **2**, p. 5.

Squalus pristis Russell, 1803, Coromandel fishes, **1**, p. 8, pl. 13.

Yahla Russell, 1803, ibid.

Pristis semisagittatus Shaw, 1804, Zool., **5**, pt. 2, p. 361; Müller & Henle, 1841, Plagios., p. 108, pl. 60; T. Cantor, 1849, Malay fishes, p. 1389; Bleeker, 1852, Verh. Bat. gen., **24**, p. 53; Duméril, 1865, Elasm., p. 477; Day, 1865, Fishes Malabar, p. 272.

Saw nearly one third of the total length, narrow and slender, tapering gradually; rostral teeth in 25–34 pairs, absent near the base. On young individuals of about two feet in total length the rostral teeth are rather wide at the base and taper from a barb on the posterior margin to an acute point. On those having rostra of two feet or more in length these teeth are still trenchant on both edges but the barb has disappeared. Spiracles and nostrils are very oblique. Oral teeth of an embryo at the time of acquiring scales in $\frac{84}{80}$ rows. Comparatively the fins are narrower and the angles sharper and more produced in this species than in any other of the genus. The pectorals are small, the outer angle is nearly a right one, somewhat blunted, and the hind margin is deeply excavated and the angle is produced. The dorsals have short bases and the inner angles are much produced; the posterior margin is deeply concave. According to Day the species reaches a length of twenty feet or more. Ascends rivers.

India to the Red Sea; East Indies.

Pristis zysron.

Pristis zysron Bleeker, 1852, Verh. Bat. gen., **24**, p. 55; Duméril, 1865, Elasm., p. 478; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 438; Day, 1878, Ind. fishes, p. 729, pl. 91, f. 2; Annandale, 1909, Mem. Ind. mus., **2**, p. 8.
Pristis dubius Bleeker, 1852, Verh. Bat. gen., **24**, p. 56; Nat. tijds. Ned. Ind., **3**, p. 459.

Rostrum long, toothed near the base, teeth 25–32, hindmost farther apart. Nostrils and spiracles moderately oblique. Outer angle of pectoral broadly rounded, hind margin convex, hinder angle not produced. First dorsal not larger than the second, originating rather behind the middle of the bases of the ventrals. Subcaudal broadly rounded on lower angle, without a trace of a lower lobe. Attains a length of twenty feet.

Distinguished from *P. clavata* by the larger number of rostral teeth, greater roundness of the outer margin of the pectoral, posterior origin of first dorsal, larger comparative size of second dorsal, and more rounded caudal fins.

India and East Indies: Ceylon, Borneo, Amboina.

Pristis pectinatus.

Le vivelle Duhamel, 1782, Traité, **4**, p. 336, pl. 25, f. 3–5.
Der saegefische Bloch, 1785, Ausl. fische, **1**, p. 41, pl. 120.
Pez de espada Parra, 1787, Hist. nat., p. 75, pl. 33.
Squalus pristis Bonnaterre, 1788, Ichth., p. 11.
Pristis pectinatus Latham, 1794, Trans. Linn. soc. London, **2**, p. 278, pl. 26, f. 2; Schneider, 1801, Bloch, Ichthy., p. 351; Risso, 1810, Ichth. Nice, p. 22; 1826, Hist. nat. **3**, Poissons, p. 141; Blainv., 1830, Poiss. Fr., p. 51; Owen, 1840, Odont., pl. 8, f. 1; Müller & Henle, 1841, Plagios., p. 109; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 36; Duméril, 1865, Elasm., p.

465; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 437; Klunzinger, 1871, Syn. fische, **2**, p. 673; Day, 1878, Ind. fishes, p. 811; Garman, 1888, Bull. M. C. Z., **17**, p. 88, pl. 23; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 60; 1900, ibid., Atlas, pl. 8, f. 27; Annandale, 1909, Mem. Ind. mus., **2**, p. 7.

Le squale scie Lacépède, 1798, Poissons, **1**, p. 286, pl. 8, f. 1.

Pristis granulosa Schneider, 1801, Bloch Ichth., p. 352.

Pristis megalodon Duméril, 1865, Elasm., p. 479, pl. 9, f. 4.

Pristis acutirostris Duméril, 1865, ibid., p. 479.

Pristis occa Duméril, 1865, ibid., p. 479.

Pristis leptodon Duméril, 1865, ibid., p. 480.

Pristis brevirostris Duméril, 1865, ibid., p. 480.

Pristis woermanni Fischer, 1884, Jahresb. Mus. Hamb. for 1883, p. 39.

Pristis annandalei Chaudhuri, 1908, Records Ind. mus., **2**, p. 391, figs.; Annandale, 1909, Mem. Ind. mus., **2**, p. 8, pl. 5, f. 4.

Rostrum of moderate width, less tapering than in either *P. pristis* or *P. microdon;* rostral teeth 25 to 32, varying with age and individual, not grooved on the posterior edge on young specimens, closer together forward, sometimes irregular in length. Teeth on the jaws in pavement, rows 88–178 above and 84 to 176 below. Spiracles and nostrils moderately oblique. Fin angles somewhat produced; outer pectoral angle blunt, margins nearly straight; origin of first dorsal opposite or a little backward to that of the ventrals; second dorsal little smaller, hind margin concave; angle sharp, not reaching the caudal; supracaudal slightly more produced than subcaudal, the latter with a trace of a lobe. A low keel at each side of the tail. Scales on the very young with broad rounded bases short pedicels and leaf-shaped crowns, which latter are more or less sharp angled posteriorly, on the greater portion of the body, but with age the crowns become modified, on the fin margins about the snout and head, and appear convex and smooth, button-shaped, and sessile.

Tropical to temperate seas.

Pristis clavata.

Plate **16**, fig. 5–7.

Pristis clavata Garman, 1906, Bull. M. C. Z., **46**, p. 208.

Body and head much depressed; tail flattened beneath, bluntly keeled on each side, subtriangular in cross section. Head, from end of snout to hindmost gill opening, nearly two fifths of the total length, saw about one fourth of the total. The twenty-one teeth at each side of the saw are long, slender, and rounded on each edge. Nostrils wide, oblique; anterior valve with a broad, rounded lobe in the middle; posterior valve narrowly free behind, in two divisions, the outer of which is extended as a partition into the nostril in a sort of flap below the lobe of the anterior valve. Distance between the nostrils greater than their

width, and more than half of that from the mouth. Mouth wide, about one sixth of the preoral length, slightly arched forward; labial folds rudimentary. Teeth very small, in pavement, seventy-eight rows in the upper series, seventy-six in the lower. Gill openings small, hindmost smallest, outer edges of valves in sigmoid curves. Eye medium, behind a vertical from the nostril, with a narrow subtriangular velum reaching downward across the pupil; orbit elongate. Spiracles half as large as the eye, obliquely placed about one diameter behind the orbit. Pectorals more than twice as long as wide, outer angle obtuse, hinder acute, free portion less than width of fin. Origin of first dorsal half way between that of the ventrals and the middle of their bases; second dorsal smaller; hind angles of fins produced, posterior margins concave. A low keel at each side of the tail; caudal fin rather small, subcaudal not lobed, obliquely truncate. The scales are very small; the earliest of them bear some resemblances to those of the very young of species of Rhina but the later growths show various modifications. The most common shape of scale perhaps is that with a broad base, a stout peduncle and a smooth depressed crown sharp angled posteriorly; another common form is that seen in the pavement squamation at the end of the rostrum and on its lower surface, a rounded smooth convex crown sessile on the base.

Olivaceous brown, yellowish to greenish, darker on the crown, fins lighter, ventral surfaces white.

Type from Queensland, Australia.

Pristis pristis.

Pristis sive serra Clusius, 1605, Exoticorum, p. 136, figs.
Squalus pristis Linné, 1758, Syst., **1**, p. 235; 1766, Syst., **1**, p. 401; Walbaum, 1792, Art. Gen. Pisc., p. 504.
Pristis pristis Klein, 1779, Neuer schaupl., **7**, p. 404.
Pristis antiquorum Latham, 1794, Trans. Linn. soc. London, **2**, p. 277, pl. 26, f. 1; Müller & Henle, 1841, Plagios., p. 105, pl. 60; Duméril, 1865, Elasm., p. 473; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 438.
Pristis serra Schneider, 1801, Bloch Ichth., pl. 70.
Pristis canaliculata Schneider, 1801, Bloch Ichth., p. 351.
Pristibatis antiquorum Blainv., 1830, Poiss. Fr., p. 49.

It is from Clusius that the species to which Linné gave the name *Squalus pristis* is identified. As figured by Clusius there are fifteen to sixteen teeth on each edge of the rostrum, the origin of the first dorsal is above that of the ventrals, the second dorsal is about as large as the first and does not reach the caudal, and there is no subcaudal lobe. Later authors give sixteen to twenty pairs of rostral teeth, trenchant on the forward edge. Rostrum broad, tapering.

Among synonyms, heretofore cited, Belon figures a rostrum that may have belonged to *P. pectinatus*; Rondelet places a saw, possibly of *P. pristis*, on the snout of a cetacean, and anything definite from Willughby, Ray, Artedi, the Fauna Suecica, the Mus. Ad. Frid., or the Systema, may be credited to Clusius.

Mediterranean Sea and Atlantic.

Pristis microdon.

Plate **55**, fig. 3; Plate **64**, fig. 2–3.

Galeus sp. Klein, 1742, Hist. pisc., miss., **3**, p. 12, pl. 3, f. 1–2.
Pristis microdon Latham, 1794, Trans. Linn. soc. London, **2**, p. 280, pl. 26, f. 4; Bleeker, 1852, Verh. Bat. gen., **24**, p. 54.
Pristis perotteti Müller & Henle, 1841, Plagios., p. 108; Duméril, 1865, Elasm., p. 474, Günth., 1870, Cat. fishes Brit. mus., **8**, p. 436; Day, 1878, Ind. fishes, p. 729, pl. 91, f. 1; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 60; Annandale, 1909, Mem. Ind. mus., **2**, p. 6.
Pristis zysron Bleeker, 1852, Nat. tijds. Ned. Ind., **3**, p. 441.
Pristis antiquorum Costa, 1854, Fauna reg. Nap.. pesc., **3**, pl. 8–9.
Pristis zephyreus Jord. & Starks, 1895, Proc. Cal. acad. sci., ser. 2, **5**, p. 383; Gilbert & Starks, 1903, Mem. Cal. acad. sci., **4**, p. 14.

Rostrum tapering like that of *P. pristis;* rostral teeth 17–22 pairs, rather distant from one another, grooved behind to form two cutting edges of which the lower is more prominent. Teeth on the jaws in $\frac{70}{72}$ rows, in pavement. Pectorals extending forward between the first gill opening and the jaws, Plate **64**, fig. 2–3; outer angle nearly a right angle, hind margin concave, angle produced. Dorsals rather large, of equal height, hind angles produced; origin of the first dorsal more than half the length of the base forward from those of the ventrals; second shorter in base and in total length, not reaching the caudal. Supracaudal pointed; subcaudal with a small lobe.

Tropical seas, entering the rivers.

Klein's figures do little more than place the dorsal with regard to the ventrals and to show the caudal lobe. Latham's figure represents only the rostrum. The measures given by Latham do not appear to be correct; they do not accord with his statement "corpus ut in congeneribus." If the snout measured 10 inches, the distance from its bases to that of the pectoral 4, the distance "between the pectoral and ventral fins 6," and the total 28 inches, the measurements must have been taken from a form differing so greatly from that of either of the other species, in the shortness of the tail (8 inches) and in the length of the body between pectorals and ventrals, that the differences could hardly have passed unnoticed. Comparing a specimen of this species, the form of which agrees with that of others of the genus, the snout of which measures 10 inches

it is found that the distance from its base to that of the pectoral is about 4, the distance from the base of the pectoral to that of the ventral is also 4, the distance from the origin of the ventrals to the end of the caudal is $15\frac{1}{2}$, that from the bases of the ventrals to the end of the caudal 14, the length of the caudal $6\frac{1}{4}$, and the total length 38 inches. The teeth on the rostrum of this specimen stand out a little more than one fourth of an inch; individuals differ in lengths of these teeth. Latham's example had teeth a fourth of an inch in length. The figure given by Day fairly represents the species as represented here, in specimens secured by Prof. L. Agassiz, on the Thayer Expedition, in the Amazon River and tributaries. On a specimen of about fifteen feet in length, the rostrum has a length of about four feet; at the base it is eight inches in width, between the outermost teeth four inches, and the longest teeth have lengths of more than two inches.

Rhinobatidae.

Body, head, and tail depressed. Disk broad posteriorly, tapering forward; pectorals continued opposite the gill openings but not in the snout. Tail strong, wide at the base, with two dorsals, a moderate to small caudal fin, and a dermal fold at each side. Nostrils oblique; each valve in three sections, an outer section and an inner separated by an elongate lobe. Teeth small, numerous, in pavement. Orbit with a fold below the eye and a projecting shield above the pupil. Spiracles large, close to the eye.

The genera of this family should be grouped in two subfamilies, one of them, the Rhynchobatinae, to include species on which the dorsal is placed above the ventrals, the caudal axis is raised and there is a well-developed subcaudal lobe, the other, the Rhinobatinae, to contain those on which the dorsal is at a distance behind the ventrals and the subcaudal is small and without a lobe.

A number of fossil species undoubtedly belonging to this family are known from the Lower Kimmeridgian, Upper Cretaceous, Upper Eocene, and Later Tertiary.

Ventrals at a distance from the pectorals; subcaudal lobed
- dorsal opposite the ventrals . . . . . *Rhynchobatinae*
  - rostrum short; snout, broad, rounded . *Rhamphobatis* (page 267)
  - rostrum long; snout pointed . . *Rhynchobatus* (page 268)

Ventrals close to the pectorals; subcaudal small, not lobed
- dorsal behind the ventrals . . . . . *Rhinobatinae*
  - rostrum long; snout pointed . . . *Rhinobatus* (page 269)

rostrum short, trough-shaped; snout blunt
pectorals in part entering the snout
nasal valves not forming an upper lip . *Syrrhina* (page 284)
pectorals not entering the snout
nasal valves forming an upper lip *Trigonorrhina* (page 287)

Rhamphobatis.

Rhamphobatis Gill, 1861, Ann. N. Y. Lyc., **7**, 408 (name only).

Head, body, and tail depressed; snout broad, blunt, rounded. Pectorals not extending beyond the jaws, united with body and head in a subtriangular disk forming about one third of the total length. Tail nearly half of the total, slender, continuous with the body to the pectorals; caudal axis raised in the fins, subcaudal lobed. Ventrals remote from the pectorals. First dorsal above the ventrals. Nostrils nearly transverse. Mouth arched forward, undulated; teeth larger on the prominences. Spiracles large, without folds. Scales small; tubercles large, compressed.

Rhamphobatis ancylostomus.

Rhina ancylostomus Schneider, 1801, Bloch Ichth., p. 352; Cuv., 1817. Reg. anim., **2**, p. 133; Gray & Hardwicke, 1834, Ill. Ind. Zool., pl. 102, f. 2; Agass., 1835, Rech. poiss. foss., **3**, p. 82, pl. H, f. 3, 4; Müller & Henle, 1841, Plagios., p. 110; Richardson, 1846, Rept. Brit. assoc. adv. sci., for 1845, p. 195.

Rhina anchylostomus Schneider, 1801, Bloch Ichth., pl. 72; Bleeker, 1852, Verh. Bat. gen., **24**, p. 51, 56.

Rhina cyclostomus Swainson, 1839, Class., **2**, p. 322.

Rhamphobatis ancylostomus Duméril, 1865, Elasm., p. 482; Annandale, 1909, Mem. Ind. mus., **2**, p. 10, pl. 5, f. 5.

Rhynchobatus ancylostomus Günth., 1870, Cat. fishes Br. mus., **8**, p. 440; Day, 1878, Ind. fishes, p. 730, pl. 193, f. 3.

Disk nearly one third of the total length, broader than long; snout semicircular in front, short, broad, angle from opposite the nostrils about 75°; rostral cartilage short, broad, ridges widely separated. Crown transversely concave. Nostrils rather narrow, two thirds of interspace, nearly transverse; valves feeble, anterior lobe short. Mouth medium, wider than the internarial space, slightly arched forward and undulated, teeth on the prominences larger. Spiracle as large as the eye, without folds. Pectorals small, outer angle produced. Dorsals of moderate size, angles produced; origin of first dorsal opposite that of the ventral, second dorsal smaller. Ventrals small, origins distant from the ends of the bases of the pectorals more than a length of the base of the first dorsal, outer angles sharp. Tail depressed, tapering regularly with the body from the

pectorals, with a dermal keel at each side. Caudal well developed, axis slightly raised, supracaudal elongate and subcaudal produced together making the hind margin of the entire caudal a deep concave. A series of irregular large tubercles from the rostral ridges above each eye to the nape, a vertebral series in front of the first dorsal, two series on each shoulder, inner longer and subcontinuous with one from the orbital ridge.

Brown; young with scattered spots of white smaller than the eye over body and fins, head and forward part of back with transverse bars of white and brown, in age becoming uniform ashy brown. Reaches a length of seven feet or more.

Africa to China; East Indies.

Rhynchobatus.

Rhynchobatus Müller & Henle, 1837, Sitz. Akad. wiss. Berlin, p. 116; 1841, Plagios., p. 111.

Disk subtriangular, longer than wide; snout elongate; pectorals narrow, not extended beyond the nostrils. Rostral cartilage long, trough-like. Nostrils wide, oblique, valves not crossing the internarial space. Mouth with moderately developed labial folds and labial cartilages; teeth unlike.

Dorsal opposite the ventrals. Origin of ventrals distant from the bases of the pectorals. Caudal axis somewhat raised, a subcaudal lobe, caudal keels weak.

Rhynchobatus djiddensis.

Plate **65**, fig. 1.

Raia djiddensis Forskäl, 1775, Descript. anim., p. 18; Gmelin, 1789, Linné, Syst., **1**, p. 1511; Shaw, 1804, Zool., **5**, pt. 2, p. 319.
Rhinobatus ou *Squatino-Raia* Duhamel, 1782, Traité, **4**, p. 292, pl. 15.
Raie bokhat Lacépède, 1798, Poissons, **1**, p. 139.
Raie rhinobate Lacépède, 1798, Poissons, **1**, p. 145, pl. 6, f. 3.
Rhinobatus laevis Schneider, 1801, Bloch Ichth., p. 354, pl. 71; Schlegel, 1850, Jap. Pisces, p. 306, pl. 139.
Rhinobatus djidsensis Schneider, 1801, Bloch Ichth., p. 356.
Walawah tenkee Russell, 1803, Coromandel fishes, **1**, p. 6, pl. 10.
Rhinobatus djeddensis Rüppell, 1826, Atlas fische, p. 54, pl. 14, f. 1; E. T. Bennett, 1830, Mem. Raffles, p. 693; Annandale, 1909, Mem. Ind. mus., **2**, p. 12.
Rhinobatus duhamelii Blainv., 1830, Poiss. Fr., p. 48.
Rhynchobatus laevis Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 116; Wiegm. archiv., **1**, p. 399; 1841, Plagios., p. 111; Bleeker, 1852, Plagios., p. 51, 58; Duméril, 1865, Elasm., p. 483.
Rhynchobatus djeddensis T. Cantor, 1849, Malay. fishes, p. 412; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 441; Day, 1878, Ind. fishes, p. 730, pl. 192, f. 1; Günther, 1910, Südsee fische, **3**, p. 491.
Rhinobatus jaram Montrouzier, 1857, Ichth. Woodlark, p. 498.

Disk wide posteriorly, three fourths of its length, narrowing forward, length about half the distance from end of snout to caudal. Snout half the length of

the disk, pointed, angled near 45° on a specimen of nineteen inches. Crown transversely convex in the middle, concave toward each edge, width less than one third length of snout. Mouth arched in the middle, with larger teeth on the arches, in 63 rows on the upper jaw of a specimen nearly six feet in length. Labial folds and cartilages well developed (Plate 65, fig. 1, *l*). Nostrils wide, oblique, narrower and curved back toward the mouth on inner ends, three fourths as wide as the mouth; valves feebly developed, nearly half the width of the nostril, anterior with a short rounded lobe and an inner section reaching one third of the distance from the lobe to the inner angle of the nostril, posterior with the outer section and the elongate lobe continuous and the inner section narrow and short. Internarial space not as wide as the nostril. Spiracle as large as the eye and close to it, with two folds. Pectorals small, not extended opposite the nostrils. Dorsals moderate, angles produced, hind margins deeply concave; base of the first dorsal more than its length behind the axil of the pectoral, origin little behind origins of ventrals, second dorsal nearly three times the length of its base behind that of the first.

Ventrals small, narrow, hind angle produced, bases more than their length behind those of the pectorals. Tail depressed continuous in width with body from the pectorals, with a narrow dermal keel at each side; caudal axis slightly raised, supracaudal pointed, subcaudal lobe prominent. A series of small tubercles above the vertebrae, two short series on each shoulder, inner larger and preceded at a short distance by another series of half a dozen on the nape, and a row on the orbital ridge, interrupted above the spiracle.

Young greyish to olive or brown with small spots of white more or less symmetrically placed on body and tail and surrounding a black spot, or in cases a ring with a light centre, as large as the spiracle, above each end of the shoulder girdle. Large individuals are uniform greyish brown.

Red Sea to East Indies, Africa to India.

Rhinobatus.

'Ρινόβατος Aristotle, ΠΕΡΙ ΖΩΩΝ ΙΣΤΟΡΙΑΣ *το* F, XI.
Rhinobates Jovius, 1524, Romanis Piscibus, c. 29.
Rhinobatos Wotton, 1552, Diff. anim., p. 144G; Salviani, 1554, Aquat., f. 153.
Rhinobatus Rondelet, 1554, Pisc., p. 370; Gesner, 1558, Aquat., p. 1084; Klein, 1742, Hist. pisc., miss., **3**, p. 32; 1749, ibid, **5**, p. 78; 1776, Neuer schaupl., **2**, p. 592; Link, 1790, Lichtenberg & Voigt's mag., **6**, stück 3, p. 32; Walbaum, 1792, Artedi, p. 581.

Disk subtriangular, wider and rounded posteriorly; pectorals rather narrow, most developed behind the shoulder girdle, narrowing to acute forward,

not produced into the snout. Snout elongate, pointed, formed by the long rostral cartilage and a vascular area at each side of it. Nostrils oblique, anterior valves not joined across the space between them, not reaching the mouth. Spiracles large, mostly with two folds on the hind margin, rarely with one or none. Ventrals close to the pectorals. Dorsals behind the ventrals. Tail depressed, robust anteriorly; caudal small, subcaudal portion weak and without a lobe.

Mediterranean and African species.

RHINOBATUS RHINOBATUS.

Rhinobatus sive squatiscorax COLUMNA, 1592, Phytob.: ed. 1744, p. 101, pl. 27; WILLOUGHBY, 1686, Pisc.: RAY, 1713, Pisc. p. 28.

Raia No. 1 ARTEDI, 1738, Ichthyologia, Syn., p. 99, Gen. p. 70.

Raia rhinobatos LINNÉ, 1758, Syst., 1, p. 232; 1764, Mus. Adol. Frid., 2, p. 52; 1766, Syst., 1, p. 397; GMELIN, 1789, Linné Syst., 1, p. 1510 part; GRAY, 1854, Gen. syst., p. 10.

Raia laeva dipterygia CAUCHOY, 1710, Zoophyt., 1, p. 26, no. 156.

Rhinobatus (rhinobatus) KLEIN, 1776, Nouv. schemph., 2, p. 106.

Rhinobatus rhinobatus BONNATERRE, 1788, Ichth. Ichth., p. 131 part; CUV., 1817, Reg. anim., 2, p. 133; RISSO, 1826, Ichth. Nice, p. 111; BONAPARTE, 1841, Icon. Fauna Ital. Pesci, Corsi, 1874, Fauna reg. Nap., pesci, 3, tav. 10; GÜNTH., 1870, Cat. fishes Brit. mus., 8, p. 446; ANNANDALE, 1909, Mem. Ind. mus., 3, p. 14.

Rhinobatus (Syrrhina) columnae MÜLLER & HENLE, 1841, Plagios., p. 113; DUMÉRIL, 1865, Elasm., p. 486.

Width of disk little less than its length. Snout angle broad, about 65°, and blunted, length less than twice the width of the mouth. Internarial space narrower than the nostril, which latter is little more than half the width of the mouth. Anterior nasal valve slightly extended inward from the edge; inner section of posterior valve larger. Mouth nearly straight. Spiracle large, with two prominent folds. Dorsals small, equal in base or in total length, anterior taller, more pointed than those of *R. lentiginosus*, Plate 17, hinder margin slightly concave. Scales very small. Small tubercles in a median series on the back, in two groups on each shoulder, and in a row above each orbit.

Back nearly uniform brownish, lighter to white at each side of the rostral cartilage.

Mediterranean Sea and Persian Gulf.

RHINOBATUS RASUS.

Plate 17a, fig. 1–2.

Rhinobatus rasus GARMAN, 1906, Bull. M. C. Z., 51, 253.

Disk narrower and more pointed in front than that of *R. rhinobatus*; crown flattened, edges of slight prominence; snout moderate, blunted, angle from

opposite the orbits about 87°, length two and two thirds times the width of the mouth. Rostral cartilage strong, ridges nearly parallel from the frontal, where the convergence is slight. No fold above the tip of the snout. Nostrils wide, two thirds of the width of the mouth, or one and one half times that of the internarial space; anterior valve feebly developed not extending half way from the lobe to the inner edge of the nostril, lobe narrow, pointed; posterior valve about two thirds the width of the nostril, lobe well developed, outer and inner sections narrow. Mouth nearly straight, width equal three eighths of the snout length. Spiracle as large as the eye, a prominent outer fold, inner rudimentary. Dorsals small, equal, pointed, concave on the hind margins; base of first less than one third of its distance from the bases of the ventrals, two fifths of that from the second dorsal. Caudal narrow, elongate. From the snout to the axils of the pectorals is about two fifths of the entire length.

Scales minute, very sharp, smoother and more closely set below the disk. Strong compressed and depressed tubercles in a dorsal row, to the second dorsal, in a pair on each shoulder, outer smaller, in a pair in front of each eye, in a row of smaller ones on each rostral ridge, and in a pair above the end of the snout as in *R. lentiginosus*. A row of small tubercles above each orbit ends in a larger one above the spiracle.

Light brownish on the back, lighter at each side of the rostrum, lighter on the lower surface. A blackish blotch beneath the end of the snout.

Specimen described from Akkra, Ashanti.

Rhinobatus blochii.

Rhinobatus (Syrrhina) blochii Müller & Henle, 1841, Plagios., p. 113, pl. 37, f. 1; Dumeril, 1865, Elasm., p. 498.

Rhinobatus blochii Cuvier, 1870, Cat. Acad. Sci. nos. 9, p. 47.

Disk subtriangular, snout to ends of bases of pectorals about one third of the total length, nearly as broad as long, margins rounded anteriorly, slightly concave opposite the gill openings. Snout short, blunt, angle from the orbits about 88°, length more than twice the width of the mouth, four times the internarial space. Rostral cartilage short, broad at the base; ridges widely separated, converging regularly. Nostrils as wide as the interspace, more than half as wide as the mouth; outer section of anterior valve feebly developed, lobe short, inner section extended upon the internarial space but not reaching the median line by a distance of half the length of the eye; posterior valve with a small outer section, extended outward beyond the nostril, an elongate lobe and a

much larger inner section which does not reach the inner edge of the nostril by about one third the length of the latter. Mouth bow-shaped, nearly straight. Crown flat, edges not prominent. Spiracle as large as the eye, with one prominent fold. Pectorals wide, rounded. Dorsals equal, high, pointed; base of first dorsal less than three times its length from the bases of the ventrals, or from the base of the second dorsal. Small compressed smooth tubercles and enlarged scales above the vertebrae, in two groups on each shoulder, outer smaller, in front of the eye, and above orbit and spiracle.

Greyish brown, lighter toward edges of pectorals and sides of snout; fins darker; lower surface whitish, with faint indications of darker below the end of the snout.

Specimen described an adult male, of thirty-one inches, from Cape Good Hope, taken by Captain J. W. Chever. In young individuals the snout is white and there are whitish spots scattered over the back.

Rhinobatus annulatus.

Rhinobatus (*Syrrhina*) *annulatus* Müller & Henle, 1841, Plagios., p. 116; A. Smith, 1849, Afr. Pisces, pl. 16.

Snout rather sharp, angle about 60°, blunted, longer than that of *R. blochii*. Rostral cartilage strong; ridges converging from the fontanel, close together in the anterior half of their length. Distance between the outer angles of the nostrils two thirds of the length of the snout, internarial space about equal to width of nostrils; anterior valve nearly reaching the middle of the space. Spiracles almost as wide as the eye, with two folds, the outer larger.

Small tubercles above the vertebrae, on the orbital ridges and above the spiracles.

Yellowish brown or grey, to greenish grey; light and tinted with flesh color below; back with numerous ocelli, of two dark rings, a light ring, and a light central spot, somewhat symmetrically placed, and of various sizes smaller than the eye. In life the light ring and the centre of the ocellus is bluish white. Closely allied to *R. rhinobatus* and *R. halavi*.

Southern and eastern Africa.

Asiatic species.

Rhinobatus granulatus.

Rhinobatus rhinobatus Schneider, 1801, Bloch Ichth., p. 353 part.
Suttiwarah Russell, 1803, Coromandel fishes, 1, p. 7, pl. 11.

Rhinobatus granulatus Cuv., 1829, Reg. anim., **2**, p. 396; Müller & Henle, 1841, Plagios., p. 117, pl. 38; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 36; Duméril, 1865, Elasm., p. 493; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 443 (part); Day, 1878, Ind. fishes, p. 732 (part), pl. 192, f. 2; Annandale, 1909, Mem. Ind. mus., **2**, p. 14.
Rhinobatus typus E. T. Bennett, 1830, Mem. Raffles, p. 694.

Snout long, pointed, length more than half the length of the disk, or about two thirds of the width of the latter, angled from the orbits in about 50°. Crown flattened, width one fourth of the distance from the mouth to the end of the snout. Rostral cartilage strong, tapering, slender forward; ridges narrowly separated by the fontanel and confluent in the anterior half of their length. Nostrils of greater width than the internarial space. Width of mouth two fifths of length of snout. Spiracles with two folds. Dorsals sharp angled above, concave behind; base of first dorsal two fifths of its distance from the bases of the ventrals, or half the distance from the second dorsal. Second dorsal little longer. Middle of back and top of head with enlarged, coarse, rough scales. Compressed, backward-directed tubercles in a vertebral series, on the shoulders and around the orbits.

Greenish gray; lower surfaces, and sides of snout, white.

Off coasts of India.

Rhinobatus acutus.

Plate **17b**, fig. 1–2.

Rhinobatus acutus Garman, 1908, Bull. M. C. Z., **51**, p. 253.

In a fifteen inch specimen the length of the snout is contained twice in the length of the disk, and one and two sevenths times in the width. Crown convex across the middle, edges slightly prominent. Snout long, slender, pointed, angled from opposite the orbits about 45°. Rostral cartilage strong, tapering to the end; rostral ridges moderately separated by the fontanel, confluent and straighter forward. Width of nostril three fourths of that of the internarial space; anterior nasal valve feebly developed, inner section hardly reaching one third of the distance from the lobe to the inner edge of the nostril, end very slightly turned forward; posterior valve with slight expanse in either outer or inner sections. Mouth nearly straight, in width about one third of the length of the snout. Eyes small. Spiracles as large as the eyes, with two rudimentary folds. Dorsals subequal, posterior borders concave, base of first dorsal one third of its distance from the bases of the ventrals, or less than half of the distance between it and the second dorsal. Scales minute on the fins, larger on

the body and the head. Broad based, compressed, hooked tubercles in the vertebral series, in front of the eye and above the spiracle, in a series on each rostral ridge, and on each shoulder.

Rusty brown, light at each side of the rostral cartilage, whitish below. No black spot below the snout.

Ceylon.

This species differs from *R. halavi* in the snout, width of nostrils, internarial space, rostral ridges, spiracular folds, and in coloration. It has a longer snout, a wider internarial space, and smaller nostrils than *R. granulatus*, from which it also differs in squamation and in shapes of fins.

Rhinobatus hynnicephalus.

Rhinobatus hynnicephalus Richardson, 1846, Rept. British assoc. adv. sci. for 1845, p. 195.

Width of disk six sevenths of the length, somewhat more than one third of the total length. Snout acuminate, blunted. One fold on the spiracle.

Color shining yellowish brown with specks of a darker tint of the same, arranged for the most part so as to form small subcircular areas. (From Richardson, described from a drawing).

Canton, China.

Rhinobatus polyophthalmus.

Rhinobatus (*Syrrhina*) *polyophthalmus* Bleeker, 1854, Verh. Bat. gen., **26**, p. 129; Nat. tijds. Ned. Ind., **7**, p. 423; 1857, Act. Soc. sci. Ind. Neerl., **3**, p. 4, pl. 4, p. 41.
Rhinobatus (*Leiobatus*) *polyophthalmus* Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 646.

Disk moderately broad; crown flattened, edges of slight prominence. Snout about one sixth of the total length, rather pointed, from opposite the orbits forming an angle of about 61°, nearly one sixth of the total length. Rostral cartilage strong; ridges converging from the skull but not confluent. Nostrils moderate, as wide as the space between them, which latter is little more than half the width of the mouth; anterior valve rather undeveloped in outer section, lobe large, inner section feeble but continued for a short distance from the nostril toward the rostral cartilage; posterior valve moderate in outer section, lobe elongate, inner section much larger than outer. Mouth small, one third of the length of the snout, somewhat arched forward in the middle. Spiracle smaller than the eye, a prominent fold on the margin. Dorsals equal in base and length of fin; anterior higher, its base one third of its distance from the bases of the ventrals, or two fifths of its distance from the base of the posterior

dorsal. Caudal small. Tubercles in the dorsal series small, hardly perceptible on the shoulders or around the orbits.

Brown, with numerous small spots and rings of darker brown scattered over the back; dorsals and caudal darker. Lower surfaces whitish tinted with olive.

Specimen described, about nineteen inches in length, from China.

Rhinobatus halavi.

Raia halavi Forskäl, 1755, Descript. Anim., p. 19.

Rhinobatus halavi Rüppell, 1828, Atlas fische, p. 55, pl. 14, f. 2; Müller & Henle, 1841, Plagios., p. 120; Guichenot, 1850, Expl. Alg., p. 129; Duméril, 1865, Elasm., p. 496; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 442; Klunzinger, 1871, Syn. fische, **2**, p. 675; Day, 1878, Ind. fishes, pl. 193, f. 4; Annandale, 1909, Mem. Ind. mus., **2**, p. 13.

Rhinobatus armatus Gray & Hardwicke, 1834, Ill. Ind. zool., **2**, pl. 99; Müller & Henle, 1841, Plagios., p. 119; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 60; Nat. tijds. Ned. Ind., **3**, p. 85; Duméril, 1865, Elasm., p. 494; Günth., 1910, Südsee fische, **3**, p. 492.

Rhinobatus obtusus Müller & Henle, 1841, Plagios., p. 122, pl. 37, p. 2; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 37; Duméril, 1865, Elasm., p. 493; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 443.

Rhinobatus granulatus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 443 (part).

Width of disk four fifths of its length, angle at the snout from opposite the eyes 57°. Tail from the bases of the ventrals one half of the total length. Snout from mouth one half the length of the disk, nearly three times the width of the mouth; tip moderately broad, regularly rounded. Rostral cartilage slender, widening in the anterior two thirds of its length; ridges narrowly separated at the fontanel, closely approximated in mid length; groove distinct anteriorly. Nostrils wide, width six sevenths of that of the mouth, twice that of their distance apart, two sevenths of the length of the snout. Anterior nasal valve feebly developed, a narrow edging on the outward three fourths of the nostril, its lobe narrow and small and its inner section, reaching halfway from the lobe to the inner edge of the nostril, turns slightly forward at the end. Posterior valve much better developed in the outer section and the lobe, which latter is much larger than that of the anterior valve; inner section not reaching half way to the inner edge of the nostril. Mouth nearly straight. Spiracles nearly as large as the eye, with a single low fold. Dorsals equal, base of the first equal two fifths of its distance from the ventrals, or one half its distance from the second, upper angle rather long and sharp, hinder margins concave. Caudal narrow, pointed.

Yellowish grey or brown, white or yellowish at each side of the rostral cartilage; pectorals and ventrals lighter, sides of tail and edges of lower fins edged with white. Lower surfaces white; a brownish spot below end of snout.

Specimens secured by Dr. Thomas Barbour in southern Celebes are more brown than that described from Singapore.

Rhinobatus thouini.

La raie thouin Lacépède, 1798, Poissons, **1**, p. 134, pl. 1, f. 3–5.
Thouinian ray Shaw, 1804, Zool., **5**, pt. 2, p. 318, pl. 147, f. 2.
Rhinobatus thouini Müller & Henle, 1841, Plagios., p. 120; Duméril, 1865, Elasm., p. 500, pl. 10, f. 2; Günth., 1870, Cat. fishes, Brit. mus., **8**, p. 442; Day, 1878, Ind. fishes, p. 732, pl. 190, f. 4.
Rhinobatus ligonifer T. Cantor, 1849, Malay fishes, p. 415, pl. 14; Bleeker, 1852, Verh. Bat. gen., **24**, p. 59.

Width of disk little more than two thirds of its length. Crown flattened, edges low. Snout elongate, nearly five sevenths of the width of the disk, three and one fourth times the width of the mouth, constricted near the end. Rostral cartilage long, narrow, slender, similar to that of *R. halavi*; ridges confluent from the narrow fontanel, broadened forward. Nostrils wide, one and one half times the internarial space; anterior valve feebly developed. Eyes small. Spiracles as large as the eyes, with two rudimentary folds, the inner hardly visible; inner section extending half way from the lobe to the inner edge of the nostril, slightly turned forward at the end; posterior valve with the three sections about equal. Mouth nearly straight, twice the width of the space between the nostrils. Scales minute, sharp; larger on the middle of the back, in two groups around the tubercles of the shoulders, on the top of the head and above the rostral cartilages. A vertebral series of compressed tubercles, several of smaller size in front of each eye and above each spiracle, and two on each shoulder, the inner one larger. Dorsals subequal; anterior smaller, its base nearly three times in the space behind the bases of the ventrals, and about twice in the distance from the second dorsal. Caudal narrow, long, pointed.

Light rusty brown, dorsals and caudal darker; lower surfaces little lighter. The peculiarly widened extremity of the snout distinguishes this species from any of the others.

Specimen described an immature male of nineteen and three fourths inches from Penang, secured by Capt. W. H. A. Putnam.

Rhinobatus schlegelii.

Rhinobatus schlegelii Müller & Henle, 1841, Plagios., p. 123, pl. 42; Richardson, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 195; Schlegel, 1850, Jap. Pisces, p. 207; Bleeker, 1857, Act. Soc. sci. Ind. neerl, **3**, p. 41; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 445; Annandale, 1909, Mem. Ind. mus., **2**, p. 15.
Rhinobatus (Leiobatus) schlegelii Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 645.

Width of disk about three fourths of its length. Snout elongate, about half the length or two thirds the width of the disk; angle in front of orbits, about

53°, on an adult male of thirty-five inches. Crown somewhat concave, edges of slight prominence. Rostral cartilage strong; ridges distinct to near the end, converging more rapidly in the third of their length nearest the skull. Internarial space one half, and nostril two thirds of the width of the mouth. Anterior nasal valve moderate, inner of the sections wider, extending halfway from the lobe to the inner edge of the nostril, thence turning forward; posterior valve well developed, inner section largest, much wider than the outer. Mouth bent forward in the middle third, width two sevenths of the length of the snout. Spiracle smaller than the eye, with two prominent folds, outer fold twice the size of the inner. Anterior dorsal little larger, base more than one third of the distance from the bases of the ventrals, or three eighths of that from the second dorsal. Caudal moderate, outlines resembling those of *R. planiceps*, Plate 17, fig. 3. Scales minute, smooth to the touch, likewise the very small tubercles of the vertebral series and that around the eye, probably rougher and comparatively larger in the young.

Back rusty brown; fins with a light edging. Lower surface brownish yellow. Whitish spaces at the sides of the rostrum are probably to be seen on the younger stages.

Japan.

Australian species.

Rhinobatus bougainvillii.

Rhinobatus (*Syrrhina*) *bougainvillii* Müller & Henle, 1841, Plagios., p. 117; Duméril, 1865, Elasm., p. 491, pl. 10, f. 1; Günth., 1870, Cat. fishes Brit. mus., 8, p. 445; Ogilby, 1888, Cat., p. 15.

Disk little longer than wide. Snout long, tapering to a point, little less in length than twice the distance between the outer edges of the nostrils. Rostral ridges rapidly converging at the sides of the fontanel, thence straight. Nostrils wider than their distance apart. Anterior nasal valve not continued beyond the inner edge of the nostril; posterior valve reaching a little beyond the middle of the nostril. Mouth strongly curved forward in the middle; median teeth small, bordered at each side by a group of larger, pointed teeth, outer teeth in both jaws smaller. Spiracles large, without folds. Scales minute, smooth; slightly prominent spines in front of the eye, an outer and one or two inner above each shoulder, and in a remotely spaced series above the vertebrae.

Uniform blackish brown, above and below or with lighter and darker spots on the tail.

Port Jackson.

Rhinobatus philippi.

Rhinobatus philippi Müller & Henle, 1841, Plagios., p. 119, pl. 39; Duméril, 1865, Elasm., p. 497.
Rhinobatus (Syrrhina) banksii Müller & Henle, 1841, Plagios., p. 123, 192; Duméril, 1865, Elasm., p. 490.
Rhinobatus bougainvillii Ogilby, 1885, Proc. Linn. soc. N. S. W., **10**, p. 464.
Rhinobatus banksii Günth., 1870, Cat. fishes Brit. mus., **8**, p. 446; Waite, 1899, Mem. Austr. mus., **4**, p. 38, pl. 3.

Disk longer than wide, width about one third of the total length. Tail nearly half, and snout to mouth more than one fifth of the entire length. Snout elongate, sharp, angle little greater than 50°. Rostral cartilage narrow, slender, slightly expanded at the end; ridges approaching closely at the fontanel, thence continuing parallel, groove hardly perceptible anteriorly. Nostrils wide, width less than twice the internarial space; anterior valve reaching half way from its lobe to the inner edge of the nostril and very little turned forward at the end; posterior valve larger in the outer section than the inner and perfectly continuous with the lobe. Mouth bow-shaped, more than twice the width of the interorbital space, one third the length of the snout. Spiracle large, folds small, inner hardly visible. Scales sharp, rough, increasing in size toward the depressed, compressed, broad-based tubercles in the vertebral series on the shoulders and in front of and above the orbit. Dorsals equal, pointed, concave on the hind margin; base of first dorsal nearly twice its length from the second and three times in the distance from the bases of the ventrals.

Back yellowish to rusty brown or olive, lighter on the fins, yellowish at each side of the rostral cartilage; lower surfaces white. An angular blotch of blackish below the end of the snout.

A close ally of *R. halavi* but separated by the great width of the internarial space, narrower nostrils, and the narrow rostral cartilage in the forward third of the length; it is separated from *R. granulatus* by greater distance between the nostrils, wider forward end of the rostral cartilage and by more nearly parallel rostral ridges.

Queensland; Australia.

Western Atlantic species.

Rhinopatus percellens.

Plate **55**, fig. 4; Plate **56**, fig. 7 (heart); Plate **65**, fig. 2 (skeleton).

Puraque Marcgrave, 1648, Hist. nat. Brasil., p. 151.
Raia percellens Walbaum, 1792, Artedi, p. 525.
Rhinobatus electricus Schneider, 1801, Bloch Ichth., p. 356.

Rhinobatus undulatus Olfers, 1831, Torped., p. 22; Müller & Henle, 1841, Plagios., p. 121, pl. 40; Castelnau, 1855, Anim., nouv., Poiss. p. 101; Duméril, 1865, Elasm., p. 498; Kner, 1867, Nov. fische, p. 417; Günth., 1870, Cat. fishes Brit. mus., 8., p. 444.
Rhinobatus glaucostictus Olfers, 1831, Torped., p. 22.
Rhinobatus marcgravii Henle, 1834, Ueber Narcine, p. 34.
Rhinobatus percellens Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 63.

Crown transversely concave, edges prominent, angle from the eyes forward about 56° in an eighteen inch adult male. Rostral cartilage narrow in the middle, broader toward the end; ridges converging at the fontanel, in the posterior two fifths of their length, thence separated by a narrow groove to the end. Mouth slightly bent forward in the middle, nearly straight; width equal four elevenths of its distance from the end of the snout. Dorsal fins small, equal, base of the first two fifths of its distance from the bases of the ventrals, or from the base of the second dorsal. The width of the nostrils equals their distance apart; anterior valve small with an elongate lobe in the middle, inner section continued but halfway to inner edge of nostril, the end slightly turned forward; inner section of posterior valve widest. Spiracles large, with two folds, outer much the larger. Scales minute with small keels, 3–8, of varying extent and position, median more or less convergent. Small depressed spines, more prominent in young, above the vertebrae to the second dorsal, in a pair on each shoulder, and in a series from the inner edge of the spiracle to the front of the orbit.

Back dark brown, more or less clouded and blotched or plain, white at each side of the rostral cartilage, varying to transverse blotches, 8 or 9 on the tail and sprinkled with small spots of white symmetrically arranged. An angular spot of black below the end of the snout from which in most cases a black streak extends back a short distance along each edge, balance of ventral surface white.

Description from an 18 inch male nearly mature, from Rio Janeiro, one of a number collected by the Thayer Expedition.

West Indies to the Plata River.

Rhinobatus lentiginosus.

Plate 17.

Rhinobatus lentiginosus Garman, 1880, Bull. M. C. Z., 6, p. 168; 1881, Proc. U. S. nat. mus., 3, p. 519; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 65; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 62; 1900, ibid., Atlas, pl. 8 & 9, f. 28.

Crown transversely concave, edges moderately prominent. Snout long, angle from the orbits forward 54°, point blunted. Groove between the rostral ridges narrowing regularly from the skull; ridges widening forward and the carti-

lage bearing a flange on the outer side of each near the end. Nostrils little wider than their distance apart, which latter is half the width of the mouth; outer section of anterior valve feeble, inner small, not reaching half way from the lobe to the inner edge of the nostril; outer section of posterior valve smaller, lobe and inner section larger. Mouth one third the length of the snout, bending forward slightly in the middle. Supraocular lobe of the orbit prominent. Spiracles smaller than the eye, with two lobes, outer larger. Pectorals moderate, broadly curved on the outer margin, sharply convex near the axil. Dorsals equal; base of first dorsal two fifths of its distance from the bases of the ventrals, or from the base of the second dorsal; posterior margins truncate. Caudal small, subcaudal prominently convex posteriorly, supracaudal not very sharp. Scales minute smooth. Small compressed and depressed tubercles, irregularly and remotely placed in a vertebral series, in a row in front of the eye and above the orbit, and in a group, of five, above the end of the snout. No tubercles on the shoulders.

Ashy brown thickly sprinkled on the back with small spots of whitish, dorsal and caudal darker; lower surfaces little lighter. A light edging on the fins is preceded on the posterior margins of pectorals and ventrals by a narrow streak of dark.

United States, Charleston, south to coast of Florida.

Rhinobatus horkelii.

Rhinobatus horkelii Müller & Henle, 1841, Plagios., p. 122, pl. 41; Castelnau, 1855, Anim. nouv., Poiss., p. 100.

Crown flattened, edges not very prominent. Snout produced, angle from the orbits forward about 58°, little more than on *R. percellens*. Rostral cartilage strong, comparatively straight; ridges parallel on their outer edges, groove narrowing from the fontanel to the end. Nostrils about as wide as the space between them; anterior valve narrow, not extending quite half way from its lobe to the inner edge of the nostril; outer section of posterior valve small, lobe and inner section subequal. Mouth twice the width of the internarial space, three tenths of the length of the snout, with a narrow arch forward in the middle. Spiracles large, with two folds, outer larger. Dorsals small, base of first dorsal two fifths of its distance from the bases of the ventrals, or from the base of the second dorsal. Scales minute, with stout pedicel; crown smooth, flattened, acute or sharp-edged, with traces of keels on younger individuals. Compressed

tubercles of moderate sizes in a vertebral series, in two groups on each shoulder, and in a row of smaller ones in front of the eye and above the orbit and spiracle. A male of twenty-eight inches is not mature, probably the species is much larger than *R. percellens* common in some of the same localities.

Back light brown to ashy, uniform or with a spot of darker at the end of the rostral cartilage, above and below. Whiter below, varying in amount of brown at each side of the snout. Description taken from specimens of from eleven to thirty-three inches brought from Rio Janeiro by the Thayer Expedition.

Distinguished from *R. percellens* by the flatness of the crown, the straight rostral ridges, the gradual narrowing of the groove, and by the lighter more uniform color.

Eastern Pacific species.

Rhinobatus productus.

Rhinobatus producta Girard, 1854, Proc. Acad. nat. sci. Phil., p. 196.
Rhinobatus productus Girard, 1858, Rept. Pacif. R. R. Fish., p. 370; Garman, 1881, Proc. U. S. nat. mus., **3**, p. 517; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 876; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 63.

Disk broad, width six sevenths of the length; tail from bases of ventrals little more than half the total length. Crown flattened, orbital edges prominent. Snout produced, angle from opposite the orbits 60°; rostral cartilage broadening toward the end; ridges convergent to the middle, thence separated by a narrow groove. A dermal flap with fringes on young of both sexes above the tip of the snout. Nostrils little wider than the space separating them; anterior valve narrow, lobe moderate, inner section extending one third of the distance to the inner edge of the nostril and slightly turning forward at the end; outer section of posterior valve narrow, inner section much larger. Mouth twice as wide as the internarial space, one third the length of the snout, slightly arched forward in the middle. Spiracles large, with two folds, outer somewhat larger. Dorsals small, equal, base of first twice in its distance from the bases of the ventrals, two and one half times in that from the second dorsal. Small tubercles surrounded by enlarged scales in a vertebral series, in an inner and an outer group on each shoulder and on the ridge around the orbit and above the spiracle. Tubercles disappearing more or less completely with age.

Olive-brown to ashy or reddish, clouded or blotched on the larger, fins lighter; lower surfaces whitish, or blotched near the mouth, with an angular spot of brown or black under the snout, fading with age.

Off the coast of California.

Rhinobatis glaucostigma.

Rhinobatis glaucostigma Jordan & Gilbert, 1883, Proc. U. S. nat. mus., **5**, p. 210; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 62.

Snout produced, blunted, length less than twice the distance between the outer angles of the nostrils, about two fifths of the length of the disk. Rostral ridges separated, converging forward. Spiracles large, smaller than the eyes, with two folds. Dorsals about equal. Small tubercles in the vertebral series, around the orbit and on each shoulder one or two.

Greyish, lighter at each side of the rostrum, with many large spots, as large as the eye, symmetrically arranged, slaty or bluish; a blackish spot below the end of the snout.

Reaches a length of thirty inches.

Gulf of California.

Apparently closely allied to *R. horkelii* and *R. leucorrhynchus;* distinguished by the spots.

Rhinobatus spinosus.

Rhinobatus spinosus Günth., 1870, Cat. fishes Brit. mus., **8**, p. 518.

Anterior nasal valve not dilated laterally. Snout much produced, the distance between the outer angles of the nostrils being one half of that between the mouth and the end of the snout. The rostral ridges are confluent, very narrow, with a very small and short groove at the base, and in their entire length provided with spines. Mouth nearly straight. Compressed spines with dilated base along the median line of the back, on the shoulder, and above the eye and spiracle; the entire upper surface rough. Snout white.

Described from a stuffed specimen, 13 inches long.

Mexico.

Rhinobatus leucorhynchus.

Rhinobatus leucorhynchus Günth., 1866, Proc. Zool. soc. Lond., p. 604; 1867, Trans. Zool. soc. Lond., **6**, p. 490; 1870, Cat. fishes Brit. mus., **8**, p. 444, fig. 1; Garman, 1881, Proc. U. S. nat. mus., **3**, p. 517; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 62; Gilbert & Starks, 1903, Mem. Cal. acad. sci., **4**, p. 14.

Disk broad, width about seven eighths of the length; snout strong, pointed, length equal half the width of the disk. Rostral cartilage strong, tapering; ridges straight, separated at the foramen by the width of the spiracle, thence converging regularly to one third of this width at the ends. Nostrils one fourth

wider than the space between them; anterior valve weakly developed, little more than half as wide as the nostrils, inner section not extending halfway from the lobe to the inner angle, end slightly carried forward; inner section of posterior valve twice as large as the outer and lobe much larger than that of the anterior valve. Mouth twice as wide as the internarial space, three eighths of the length of the snout, with a low arch forward in the middle. Spiracle smaller than the eye, with two folds, outer twice the size of the inner. No dermal fringe above the tip of the snout. Dorsals small, equal, base of anterior about one third of its distance from the bases of the ventrals or two fifths of that from the second dorsal. Scales minute, smooth; larger above the vertebrae, in the two groups on each shoulder, in front of the eye and above the orbit and spiracle.

Back uniform brown, lighter outward on the pectorals disk and fins to a narrow margin of white; snout white. Lower surfaces white to yellowish or flesh color. A brown spot below the end of the rostral cartilage.

Described from an adult male of twenty and one half inches; tail from bases of ventrals twelve inches.

Panama.

Rhinobatus planiceps.

Plate **17a**, fig. 3–4.

Rhinobatus planiceps Garman, 1880, Bull. M. C. Z., **6**, p. 168; 1881, Proc. U. S. nat. mus., **3**, p. 520; 1888, Bull. M. C. Z., **17**, p. 89, pl. 24; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 64.

Width of disk about five sixths of its length. Tail longer than the body. Snout moderate, angle from opposite the orbits 60° or more, broad and rounded at the end. Rostral cartilage strong, a flange at each side of the end; ridges widening forward, and the groove between them widening backward. A fringed fold above the tip of the snout, on young. Nostrils wide; internarial space equal two thirds of the nostril, or half the width of the mouth; anterior valve with a narrow pointed lobe, and a very narrow inner section which does not reach the middle of the distance from the lobe to the inner edge of the nostril; posterior valve with outer and inner sections of like shapes, broadly rounded, inner larger, lobe larger than that of the anterior valve. Mouth slightly arched forward in the middle, width about two fifths of the length of the snout; labial folds weak. Crown flat; interorbital space three fourths the width of the mouth. Spiracle large, with a rudimentary fold.

Dorsals small, subequal, base of the first nearly twice its length from the second dorsal, and from the bases of the ventrals, upper ends rather pointed.

Subcaudal narrow, rounded below. Scales minute, sharp-edged or acute, smooth or with low carinae. Small tubercles above the vertebrae, in two groups on each shoulder, above the orbit and the spiracle and on very young individuals in a series above each of the rostral ridges. Old specimens have all of the tubercles comparatively smaller.

Dark brown, in cases clouded, with or without small spots of white, symmetrically arranged, along the back, Plate 17a, fig. 3, fins and edges of disk lighter, snout at the sides of the rostral cartilage white; lower surface white, with or without a black spot below the end of the snout.

Peru to the Galapagos Islands.

Syrrhina.

Syrrhina (subgenus) Müller & Henle, 1841, Plagios., p. 113 (part).
Zapteryx Jordan & Gilbert, 1880, Proc. U. S. nat. mus., 3, p. 53.

Disk subround, broader than long; snout short, broad; tail more than half the total length. Rostral cartilage strong, tapering with ridges convergent but not confluent to shovel-shaped with ridges nearly parallel. Nostrils nearly transverse; anterior valve extended on the internarial space. Mouth arched; upper lip distinct in front of the middle. Spiracles large, near the eyes. Pectorals broadly expanded posteriorly, but little continued in the snout. Ventrals close to the pectorals, claspers knobbed at the end. Tail rather slender, with a fold on each side; supracaudal fin longer; subcaudal not lobed.

The subgeneric rank of Syrrhina was claimed by Müller and Henle on account of the extension of the anterior nasal valve on the interspace. As noted by Günther, this is a feature that varies much in the species of Rhinobati. In fact, as may be seen from the descriptions herewith, on nearly or quite all of these species the inner end of the valve is started beyond the nostril for a short distance. The generic rank was claimed later because of the broader, rounder disk, from greater development and forward extent of the pectorals, the shortness of the snout, the transverse nostrils, and the greater proportional distinction between tail and disk. The genus contains but one of the species placed by Müller and Henle in their subgenus; two others are added.

Brazil; California to Panama.

Pectorals extending nearly halfway from nostrils to end of snout
rostral ridges converging forward
coloration uniform or clouded with brown . *brevirostris* (page 285)

Pectorals not extending halfway to end of snout
rostral ridges nearly parallel;
transversely banded or blotched . . *exasperata* (page 286)
spotted with yellowish ocellae . . . . *xyster* (page 286)

Syrrhina brevirostris.

Plate 65, fig. 3.

Rhinobatus (Syrrhina) brevirostris Müller & Henle, 1841, Plagios., p. 114, pl. 36; Castelnau, 1855, Anim. nouv., Poiss., p. 100; Duméril, 1865, Elasm., p. 489.
Rhinobatus brevirostris Günth., 1870, Cat. fishes Brit. mus., **8**, p. 447.
Syrrhina brevirostris Garman, 1888, Bull. M. C. Z., **17**, p. 89, pl. 25.

Disk broadly rounded, broader than long, angle in front of orbits about 105°; tail from bases of ventrals half the total length. Crown deeply concave transversely, orbital edges prominent. Snout short, less than twice the width of the mouth; rostral cartilage strong, wide at the base, tapering rapidly to a sharp point; rostral ridges far apart at the base, converging regularly forward. Nostrils nearly transverse, little less in width than the internarial space, hardly half that of mouth; outer section of anterior valve undeveloped, lobe large, inner section extended on the interspace more than halfway to the middle line; outer and inner sections of posterior valve small, subequal, covering about half the edge of the nostril, lobe narrow, slender, much smaller than that of the anterior valve. Mouth nearly straight, width less than twice that of the internarial space, more than half the length of the snout. Teeth small, flat, smooth, in 74 rows on the upper jaws of a specimen of eighteen and one half inches. Eyes moderate. Spiracle as large as the eye, with one fold. Scales small, intermixed with larger ones; prominent tubercles in a series above the vertebrae to the second dorsal, in two rows of two or three each on each shoulder, in a pair in front of each eye, in another pair above each spiracle, and in a row of small ones above each orbit. Tubercles striate on their sides, nearly covered by skin and scales. Dorsals equal base of first, two thirds of distance from second or two fifths of distance from bases of ventrals, hind margins convex. Caudal short, broadly rounded posteriorly.

Olive-brown on head and middle of back, lighter toward edges of disk and fins. A blackish spot below the posterior extremity of the pectorals.

Specimen described from Rio Janeiro, Thayer Expedition.

Brazil.

Syrrhina exasperata.

Platyrhina exasperata Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, p. 32, 53.
Zapteryx exasperata Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, p. 53; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 64.
Trigonorhina alveata Garman, 1880, Bull. M. C. Z., **6**, p. 169.
Syrrhina exasperata Garman, 1881, Proc. U. S. nat. mus., **3**, p. 521.
Rhinobatus exasperatus Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 63.

Disk wider than long, without the ventrals; snout short, broad, truncate. Rostral cartilage stout, wide, not tapering; ridges nearly parallel. Nostrils transverse, nearly as wide as the interspace; anterior valve slightly extended beyond the nostril at the inner end; outer section of posterior valve narrow, curving forward around the end of the nostril. Mouth large, bow-shaped, width two thirds of the length of the snout; teeth small, one hundred and ten series on the upper jaw of a male of 33.4 inches. Spiracle large, fold rudimentary or absent. Pectorals large, broad, and rounded posteriorly, not extended beyond the nasal region into the snout. Ventrals close to the pectorals; claspers long, slender, with a knob at the end. Dorsals equal, tips rounded, hinder margin straight, inner angle blunt; base of first dorsal more than twice its length behind the bases of the ventrals, nearly twice its length from that of the second dorsal. Tail less than one and one half times the length of the body, with a low dermal fold along each side; axis of caudal not raised; subcaudal fin shorter, with a convex margin. Scales small, with larger ones thickly scattered over the back, about the eyes, and on the rostral ridges. Larger tubercles, almost covered by the skin and scales, in a median series on the back and in two short rows on each shoulder the outer one of which is longer.

Greyish or olive-brown with indefinite and irregular transverse bands of brown across the snout, in front of and between the eyes, and across the back and the tail. Dorsals and caudal with faint bands or blotches. Lower surfaces white with a large spot of blackish below the end of each pectoral.

Specimen described from San Diego, California, secured by the Hassler Expedition.

Syrrhina xyster.

Syrrhina exasperata Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 621.
Zapteryx xyster Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 65.

This species is said to have the disk broader than long, to have the same coloration as the preceding species, and also to have several round black-edged yellowish spots as large as the pupil; one on each side of the shoulder, another

on the pectoral near the hinder angle and a third midway between the latter and the vertebrae. Several other less conspicuous spots are seen near the middle of the fore part of the back.

Panama.

Trigonorrhina.

Trigonorrhina Müller & Henle, 1838, Charlesworth's mag., 2, p. 90; 1841, Plagios., p. 124.

Disk broad, shorter than the tail; pectorals not extended in front of the nostrils; rostral cartilage strong, broad at the fontanel, tapering, blunted; tail not wide at the base, moderately slender. Origins of ventrals close to axils of pectorals. Dorsals remote from the bases of the ventrals. Subcaudal, not lobed. Nasal valves confluent in a broad quadrangular flap, forming the front edge of the mouth, free on the lateral edges behind the nostrils. Spiracle large, close to the eye, with a fold. More closely allied to Syrrhina than to Rhinobatus.

This genus contains one living species. A fossil form, *T. dezignii* Heckel, has been described from the Middle Eocene of North Italy.

Trigonorrhina fasciata.

Trigonorrhina fasciata Müller & Henle, 1841, Plagios., p. 124, pl. 43; Duméril, 1865, Elasm., p. 502, Günth., 1870, Cat. fishes Brit. mus., 8, p. 448.

Disk as broad as long, about one half of the total length without the caudal. Snout broad, blunt angled; rostral cartilage strong, tapering, blunted, ridges convergent. Tail near one and one half times the length of the disk; caudal narrow, subcaudal not lobed. Dorsals higher than long, truncate; first dorsal more than one length of its base behind the bases of the ventrals, second midway between the first and the caudal. Ventrals narrow, produced, origins close to bases of pectorals. Anterior narial valves united across the internarial space, covering the posterior valves and the greater portions of the nostrils, reaching the mouth. Tubercles more or less covered by skin and scales, in a vertebral series, in two groups on each shoulder and in a row from in front of the eye to above the spiracle.

Brown or greyish brown, with wavy bands of dark-edged bluish. Snout lighter. Lower surfaces whitish darker toward edges.

Australia; Tasmania.

Discobatidae.

Disk short and broad; pectorals wide, rounded, continued to the end of the snout. Snout broad, blunt. Tail rather slender, with two dorsals far behind

the ventrals, a dermal fold along each side, and a moderately elongate caudal in which the axis is not raised and the subcaudal fin without a lobe nearly equals the supracaudal in development. Nostrils almost transverse; valves varying in the different genera. Approaching the Rhinobatidae more closely in the genus Syrrhina.

The affinities of the genera placed in the Discobatidae are peculiarly directed:— Discobatus is intermediate between the Rhinobatidae and the Narcacionidae; Zanobatus, supposed to be oviparous, is nearer to the Raiidae between it and the Rhinobatidae, while Platyrhinoides connects Discobatus and Zanobatus though certainly viviparous. It may be that Zanobatus is not so different in regard to oviparity as would seem to be the case from the discovery of an egg in its shell within the oviduct. As figured the shell somehow has the appearance of one in which the embryo may be developed before extrusion.

Rostrum short, broad, not half the length of the snout; two dorsal fins
anterior narial valves not joined across the internarial space
Discobatus (page 288)

Rostrum extending to the end of the snout, pointed; two dorsal fins
anterior narial valves not joined across the interspace
Platyrhinoidis (page 290)
anterior valves joined across the interspace . *Zanobatus* (page 291)
Rostral cartilage absent; one dorsal fin . . *Arhynchobatus* (page 292)

Discobatus.

Discobatus Garman, 1881, Proc. U. S. nat. mus., **3**, p. 523.

Disk broad subcircular, or subtriangular with angles broadly rounded. Pectorals very broad, forming the end of the snout, where they are rather narrowly separated. Rostral cartilage short, broad, not extended half the distance from the skull to the end of the snout, truncate and supplemented by soft prolongations, somewhat as in the Narcacionts. Nostrils nearly transverse, connected with the mouth by a deep groove; anterior narial valve extended upon but not crossing the internarial space. Eyes small. Spiracles close to the eyes, with a cartilage at each side, without folds. Tail slender, about half the total length. Ventrals close to the pectorals. Dorsals far behind the ventrals, small, rounded. Caudals about equal, truncate; subcaudal not lobed.

Japan; China.

Discobatus sinensis.

Plate 56, fig. 8 (heart); Plate 66.

La Raie Chinoise Lacépède, 1798, Poissons, **1**, p. 34, 157, pl. 2, f. 1.
Rhina sinensis Schneider, 1801, Bloch Ichth., p. 352.
Platyrhina sinensis Müller & Henle, 1841, Plagios., p. 125, pl. 44; Duméril, 1865, Elasm., p. 576; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 471.
Discobatus sinensis Garman, 1881, Proc. U. S. nat. mus., **3**, p. 522; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 647.

Disk subround, deeper at the shoulders than at the head; head broad, depressed, transversely concave. Snout short, very blunt, length less than twice the width of the mouth, flexible. Mouth nearly straight; teeth very small, 112 rows on the upper jaws of the specimen described and 115 rows on the lower, smooth to the touch, with sharp edge turned toward the mouth cavity. Nostrils small, narrow, two thirds of the width of the interspace, nearly transverse; anterior valve with a feeble outer section, a strong lobe, and a moderate inner section extended somewhat on the internarial space; posterior valves with outer section largest and curving around the outer end of the nostril, lobe small, and inner section narrow, extending over half the width of the nasal chamber and ending at the edge of the deep groove from the inner half of the nostril to the angle of the mouth. Eyes small. Spiracles moderate, close to the eyes, without folds, with a cartilage at each side. Aural openings close together. Rostral cartilage short, broad, truncate, not extending half way to the end of the snout, anteriorly continued by soft or semi cartilaginous rods, much as in Narcacion and other electric rays. Pectorals very wide extending to the tip of the snout, with more than half their width in front of the shoulder girdle, narrowly separated in front. Ventrals broad, close to the pectorals. Dorsals equal, rounded, length of base of the first dorsal about one third of the distance behind the bases of the ventrals, little less than the distance from the second dorsal. Caudal rather small, depth less than one third of its length, subtruncate, supracaudal and subcaudal being about equal in length. A dermal fold at each side of the tail. Vent near the end of the forward half of the entire length. Scales minute, compact, smooth to the touch, with scattered enlarged granules above the body cavity, around each of the twenty or more small tubercles in the vertebral series, around each of those in the two pairs on each shoulder, in the pair above each spiracle and around each of the single ones at the front of the orbit. Small tubercles in four or five series, and larger sharper granules, appear along the outer edges of the anterior half of the pectorals. The inception of an electric battery, from the ampullae, is clearly indicated, Plate 66.

Dark olive-brown, each of the three small tubercles at each side of the interorbital space, each of the three on the middle of the back and each of those in the two pairs on each shoulder surrounded by whitish or light yellow. Lower surfaces white, blotched, or clouded with olive beneath the hinder parts of the pectorals, the ventrals and the tail.

Specimen described from Japan. Alan Owston.

Platyrhinoidis.

Platyrhinoidis Garman, 1881, Proc. U. S. nat. mus., **3**, p. 522.

Disk wider than long, very broadly rounded in front and at the sides. Snout short, not projecting; pectorals extending to the end, where they are separated by a wide space at each side of the rostrum. Rostral cartilage short, broad at the base, tapering to the end. Nostrils nearly transverse; anterior valve slightly extended on the internarial space beyond the nostril. Mouth bow-shaped with a shallow upper lip across the entire width. Eye small. Spiracles large, close to the eye, without folds. Dorsals small, far behind the ventrals, without a posterior angle. Tail slender, with wide dermal folds; caudals elongate.

Platyrhinoidis triseriata.

Platyrhina triseriata Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, p. 36.
Platyrhinoidis triseriata Garman, 1881, Proc. U. S. nat. mus., **3**, p. 522; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 65.
Rhinobatus triseriatus Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 64.

Disk subround, broader than long; body about three sevenths of the total length. Pectorals very broad, wider in front of the shoulder girdle, reaching the end of the snout. Snout short, broad, rounded; rostral cartilage strong, broad at the base, tapering to a point; ridges distant from one another at the fontanel, confluent at the ends. Nostrils nearly transverse, narrower than the interspace; outer section of anterior valve rudimentary, inner continuous with the lobe, slightly extended on the internarial space; posterior valve with outer section little curved at end of nostril, inner section and lobe feeble. Mouth bow-shaped, width more than two thirds of the length of the snout; teeth small, in 82 rows on the upper jaw of a twenty-two inch specimen. Crown broad, concave transversely. Eye small. Spiracles larger, close to the eye. Pectorals converging little at the sides of the rostrum. Ventrals close to the pectorals, without notches. Dorsals small, equal, shaped like those of Raia, narrow with hinder and lower margins a continuous curve; base of first dorsal, more than four

times in its distance from the bases of the ventrals, one and one half times in its distance from the second. Second dorsal reaching the caudal. Tail slender, longer than the body; dermal folds thin and wide; caudal fins about equally developed, narrow, supracaudal little longer. Scales minute. Tubercles with strong compressed backward-directed cusps in a median and two lateral series on back and tail, in a group of three or more above the end of the rostral cartilage, in a band of several to five or more tubercles in width along the forward half of each pectoral, in a series on each orbital ridge, and in two pairs on each shoulder.

Color nearly uniform brown, whitish beneath and at each side of the rostral ridges. The posterior lateral edges of the pectorals are brown on the lower sides.

Viviparous.

Off the coasts of California.

Zanobatus, gen. nov.

Disk wider than long, subround; tail slender, nearly half the total length. Snout short, blunt; rostral cartilage small, tapering gradually. Nostrils transverse, narrow, interspace wide; anterior valves confluent, posterior with inner section large, reaching the mouth. Spiracle large, without a fold. Fins rounded. Pectorals very broad, separated at the end of the snout. Ventrals close to the pectorals. Dorsals small, far behind the ventrals. Caudal small, rounded.

Compared with Discobatus this genus possesses more affinities with the Raiae and not so many with the Narcaciontidae. Though quite as closely related to the Rhinobatidae as that genus, Zanobatus is readily distinguished by the rostrum, nasal valves, and the caudal.

Zanobatus schoenleinii.

Platyrhina schoenleinii Müller & Henle, 1841, Plagios., p. 125, pl. 45; Duméril, 1865, Elasm., p. 577; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 471.
Discobatus schoenleinii Garman, 1881, Proc. U. S. nat mus., **3**, p. 523 (name).

Disk subcircular, wider than long; snout blunt, length little greater than the distance between the outer edges of the nostrils, or less than twice the width of the mouth, angle nearly 120° in front. Nostrils narrow, half as wide as their distance apart; anterior valves united across the internarial space; posterior valves with inner section as wide as both outer section and lobe and extending nearly to the angle of the mouth. Mouth nearly straight; teeth small.

Spiracles large, without folds. Scales unlike, minute, and larger. Dorsals small, equal, rounded; origin of the first dorsal more than three times the length of the base behind the bases of the ventrals. Caudal small, rounded; subcaudal not lobed. Small tubercles in the vertebral series, above the rostral cartilage, on the orbital ridges, above the basal cartilages of the pectorals and in a row of three on each shoulder.

Back brown with darker cross bands and with spots between them toward the edges of the pectorals. Lower surfaces brownish, irregularly mottled with brown.

India.

Müller found an eggshell resembling that of a Catuloid shark in the oviduct of the type specimen. Whether the egg is hatched before extrusion, as in certain Antacea, is still to be determined.

Arhynchobatis.

Arhynchobatis Waite, 1909, Rec. Canterb. mus., **1**, no. 2, p. 20.

Snout unsupported by a rostral cartilage; pectorals contiguous in front, narrowly separated by the snout. Spiracles close behind the eyes. Anterior nasal valves reaching the mouth, joined to the isthmus in a deep median notch; posterior valves tube-like as in Raia. Tail long, depressed, with a lateral fold on each side, with a single dorsal fin near the end, and with a well-developed caudal fin.

Arhynchobatis asperrimus.

Arhynchobatis asperrimus Waite, 1909, Rec. Canterb. mus., **1**, no. 2, p. 20, pl. 20.

Disk little wider than long, front angle blunt, tip of snout a slight prominence. Mouth moderate, slightly curved. Teeth small without cusps. Anterior nasal valves subtriangular. Spiracles close behind the eyes. Back rough with closely set small spines, larger on the head; larger spines occur above the shoulder girdle and the forward vertebrae. Strong tubercles appear in a median row and several lateral rows on the tail. Dorsal small, near the caudal, space between without spines equal dorsal base. Tail about half the total length, depressed, with lateral folds; caudal fin well developed, near the single dorsal. Length of type, a female, 64 cm., little more than 25.5 inches.

Back uniform purplish grey; lower surface yellow.

Bay of Plenty, New Zealand, from 66–94 fms.

Narcacionidae.

Head, trunk, electric organs, and pectorals forming a smooth, depressed, subcircular disk. Tail short, broad-based, with a short deep caudal and with or without a longitudinal fold on each side. Caudal not lobed. Dorsals two, one, or none. Spiracles present. Gill openings small, between the electric organs and the head. An electric organ of vertical cells, a development from the ampullae, at each side of the head separating it from the pectoral. Anterior nasal valves reaching the mouth, confluent, and somewhat free, as a lip, behind their median attachment. Antorbital cartilages extended forward to support the edges of the disk. Rostrum short, more or less branching. Lateral line rudimentary on the lower side of the disk, the remnants known as the vesicles of Savi. Skin soft, naked.

Two dorsals
- disk elongate
  - tail long, without lateral folds
    - eyes obsolescent . . . . *Benthobatis* (page 294)
- disk subcircular, of medium size
  - tail elongate with lateral folds
    - ventrals distinct; spiracles near the eyes . *Narcine* (page 296)
- disk medium, circular
  - tail moderate, with lateral folds
    - ventrals united; spiracles not fringed . *Discopyge* (page 302)
- disk comparatively large, elongate
  - tail very short
    - ventrals united; spiracles fringed . . *Hypnarce* (page 303)
- disk large, broad, subcircular
  - tail short, with lateral folds
    - ventrals distinct; spiracles a short distance from eyes *Narcacion* (page 304)

One dorsal
- disk subcircular
  - tail medium, with lateral folds
    - spiracles close to the eye, not fringed . . *Narke* (page 312)

No dorsal
- disk subcircular, longer than tail
  - teeth blunt, papillae behind the bands $\frac{1}{2}$. *Temera* (page 315)

Benthobatis.

Benthobatis Alcock, 1898, Ann. mag. nat. hist., ser. 7, **2**, p. 145.

Disk little longer than broad, snout more than one third of the length. Tail distinct, longer than the disk, with two dorsals and a well-developed caudal and without lateral folds. Anterior nasal valves confluent in a quadrangular flap, an upper lip. Mouth small, protractile. Teeth in bands as in Narcine. Eyes small, rudimentary. Spiracles moderate, close behind the eyes. An electric organ between the head and the pectoral. Skin smooth, soft.

A deep-sea genus, allied to Narcine, from the Bay of Bengal.

Eyes obsolete
  disk less than half the total length; no lateral folds on the tail
    body black . . . . . *moresbyi* (page 294)
  disk half the total length; tail with lateral folds
    body fawn color; with spots of white . . *marcida* (page 295)
Eyes probably functional
  subcaudal and supracaudal equally developed
    body fawn color, with spots of white . . *cervina* (page 295)

Benthobatis moresbyi.

Benthobatis moresbyi Alcock, 1898, Ann. mag. nat. hist., ser. 7, **2**, p. 145; 1899, Cat. deep-sea fishes Indian mus., p. 18; 1900, Ill. zoöl. Investigator, pl. 26, f. 1.

Disk subcircular, length more than width, more than one third preoral. Tail longer than disk. Eyes rudimentary, obsolescent, unpigmented, optic nerve slender. Mouth small, protractile; teeth bands narrow, of about ten rows; each tooth acute angled inward, toward the mouth cleft. Gill openings large, hindmost one nearer to vent than to mouth. Dorsals rather close together; first dorsal above hinder portions of ventrals. Ventrals distinct, rather large, broad, outer angle blunt; claspers short, rounded, blunt. Skin smooth, soft, purplish black, with scattered pores small and white over the disk and at the edges.

Specimens described, about fourteen inches in length, secured off the Travancore Coast, in 430 fathoms.

The published figure of this species makes it evident that the nearest ally of the genus is Narcine, with which the rostral structure best agrees. Of the

known species that to which it presents the most evident affinities is *Narcine timlei*, originally described from Tranquebar and ranging from the East Indies to Japan. These species inhabit different depths of the same waters and will probably be found to be somewhat closely connected by ties of descent.

Benthobatis marcida.

Benthobatis marcida Bean & Weed, 1909, Proc. U. S. nat. mus., **36**, p. 677, fig.

Disk broadly ovate, as long as broad, narrowing forward. Nasal valves confluent into a broad flap. Teeth flat or concave on the crown with a point projecting toward or into the mouth cleft. Eyes absent or rudimentary. Spiracles large, a short distance behind the eyes, without fringes or papillae on the edges. A large electric organ between head and pectorals. Ventrals adnate to body and tail in their entire length; rays feeble. First dorsal inserted little in advance of hind edge of ventrals; second dorsal much larger than the first. Tail half the total length, with distinct lateral folds; caudal large, obovate, subcaudal portion obliquely rounded.

Back light fawn color, fading toward the edges, with a few scattered spots of white; lower surfaces dirty white.

Total length 0.49, disk 0.21, body 0.245, tail 0.245, and width of disk 0.215 metres.

Station 2660. Lat. 28° 40′ N.; Long. 78° 46′ W.; 504 fathoms. Albatross.

Benthobatis cervina.

Benthobatis cervina Bean & Weed, 1909, Proc. U. S. nat. mus., **36**, p. 679.

Disk narrower than long, little wider than that of *B. moresbyi*, length slightly less than half the total. Nasal valves confluent. Teeth rhombic, occupying nearly the whole length of the jaw, flat or concave on the crown, with an acute projection toward and into the mouth cleft. Eyes less reduced than those of either *B. moresbyi* or *B. marcida*, possibly functional. Spiracles a short distance behind the eyes. An electric organ between head and pectorals. Ventrals about as in *B. moresbyi*. Second dorsal larger than the first. Caudal equally developed in supra- and subcaudal portions, hind margin rounded. Skin loose and soft.

Back light fawn color, fading at the edges, with a few small scattered spots of white; beneath dirty white.

Total length 0.33, length of body 0.163, length of disk 0.155, and width of disk 0.13 metres.

Station 2664. Lat. 29° 41′ N.; Long. 79° 55′ W.; 373 fathoms. Albatross.

Narcine.

Narcine Henle, 1834, Ueber Narcine, p. 31.
Cyclonarce Gill, 1861, Ann. N. Y. lyc., **7**, p. 387.
Narcine Gill, 1861, Ann. N. Y. lyc., **7**, p. 387.
Gonionarce Gill, 1861, Ann. N. Y. lyc., **7**, p. 387.

Disk subcircular, shorter than the tail; snout strong, produced, rigid in adult; tail moderate, with two dorsals, a well-developed caudal fin and lateral folds. Ventrals distinct, inserted below the ends of the pectorals. Mouth transverse, protractile; teeth in narrow bands on the skin, which is loosely attached to the jaws. Anterior nasal valves united in a broad, free-margined flap reaching the mouth; posterior valves feebly developed. Spiracles close behind the orbits or at a short distance from them, with or without a fringe of papillae. Rostral cartilage elongate, stout, broad, trough or shovel-shaped.

West Indies to Brazil; Australia; Northern Indian Ocean to China and Japan.

Spiracles fringed with papillae
- origin of first dorsal little behind ends of ventral bases
  - caudal not angular, vertically subtruncate . *brasiliensis* (page 297)
  - *bancrofti* (page 298)

Spiracles with rudimentary papillae . . . . *corallina* (page 298)
- origin of first dorsal little behind bases of ventrals
  - caudal angular, vertically truncate . . . *lingula* (page 298)

Spiracles without papillae, near the orbits; nasal valves short
- origin of first dorsal opposite ends of ventral bases
  - caudal elongate, rounded behind
    - rostral ridges divergent; brown, darker spotted *indica* (page 299)
- origin of first dorsal little behind ends of ventral bases
  - rostral ridges divergent; skin spotted, light edges *timlei* (page 300)
  - rostral ridges strongly divergent; color uniform *brunnea* (page 300)
- origin of first dorsal its basal length behind the ventral bases

caudal obliquely rounded

rostral ridges long, nearly parallel . . *firma* (page 301)

Spiracles without papillae, at a short distance from orbits

origin of first dorsal above ends of the ventrals

nasal valves short . . . . . *tasmaniensis* (page 301)

origin of first dorsal above ends of ventral bases

nasal valves long . . . . . *mollis* (page 302)

Narcine brasiliensis.

Plate **26**, fig. 1.

Raia sp. Gronow, 1763, Zoophy., **1**, 35, no. 153, pl. 9, f. 3.
Torpedo ocellata Quoy & Gaimard, 1824, Voy. Uran., Poiss., p. 199.
Torpedo brasiliensis Olfers, 1831, Torpedo, p. 19, pl. 2, f. 4.
Narcine brasiliensis Henle, 1834, Ueber Narcine, p. 31, pl. 1, f. 1, 2; Müller & Henle, 1841, Plagios., p. 129; Duméril, 1852, Torpedo, p. 32; 1865, Elasm., p. 574; Kner, 1867, Nov. fische, p. 418; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 453; Garman, 1888, Bull. M. C. Z., **17**, p. 93, pl. 33.
Narcine nigra Duméril, 1852, Torpedo, p. 37; 1865, Elasm., p. 515, pl. 11, f. 4, 4ª.

Disk subcircular, or including ventrals suboval. Nostrils small, near the mouth; anterior valves short, confluent in a broad flap, free behind and indistinctly three lobed, angles rounded; posterior valves rudimentary, forming the partition in the nostril then passing back into the fold at the angle of the mouth. Mouth small protractile, surrounded by a deep fold, with fleshy lips which are divided at the middle of each jaw by the narrow teeth-bands. Teeth small, bands narrow and extended outward on the skin beyond each jaw; each tooth with an acuminate angle on the crown directed inward; rows $\frac{36}{36}$ on an eighteen inch specimen, $\frac{24}{24}$ on one of thirteen inches, $\frac{15}{16}$ on one of six and three-fourths, and $\frac{13}{12}$ on one of four and one half inches. Eyes small, prominent. Spiracles as large as the eyes, close behind the orbits, fringed on the margins by a dozen or more low papillae. Ventrals with convex margins; claspers of the male, short, blunt. Dorsals equal, rounded, origin of first dorsal, little behind the ends of the bases of the ventrals, base longer than distance from second. Tail shorter than the disk, depressed, broad-based, tapering rapidly, lateral folds from middle of first dorsal. Caudal nearly as long as deep, rounded on the hind margin.

Brown, dark to yellowish, with a broad blotch of darker brown across the head in front of the eyes, another interrupted one across the back of the head, one or two likewise broken across the hind part of the body, one to three across the ventrals, and one through each dorsal on the caudal region; margins of fins

somewhat yellowish. A considerable variation obtains in different individuals and in a single individual at different ages, also in the species at different portions of its range. Two of these, sufficiently distinct for recognition, are given below.

Coast of Brazil.

Narcine brasiliensis bancrofti.

Plate **26**, fig. 2.

Raia laevis Gronow, 1763, Zoophy., **1**, p. 37, no. 158, pl. 9, f. 3.
Torpedo bancrofti Griffith, 1834, Cuv. anim. kingd., **10**, pl. 34.
Torpedo pictus Gray, 1854, Gron. syst., p. 13.
Narcine punctata Garman, 1881, Bull. M. C. Z., **11**, p. 233.

Brown color of the back leaden or greyish, areas similar to those occupied by the blotches of *N. brasiliensis* are more or less completely indicated in outline by small spots of dark irregularly scattered over the disk.

Jamaica to St. Vincent.

Narcine brasiliensis corallina.

Plate **26**, fig. 3.

Narcine corallina Garman, 1881, Bull. M. C. Z., **11**, p. 234.
Narcine umbrosa Jordan, 1884, Proc. U. S. nat. mus., **7**, p. 105.
Narcine brasiliensis Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 78, pl. 13 (part); Coles, 1910, Bull. Amer. mus. nat. hist., **28**, p. 337.

Orange or red, with a dark brown band across the head, interrupted on the forehead, and with small spots of dark to some extent outlining areas resembling in shapes and positions those occupied by the blotches of *N. brasiliensis*.

Florida Keys.

Narcine lingula.

Narcine lingula Richardson, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 196; Duméril, 1865, Elasm., p. 516; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 452.

Disk less than half the total length, broad, subovate, nearly round, slightly narrowed and margins straighter opposite the head, wider than long. Snout strong, broadly rounded in front. Crown convex transversely. Anterior nasal valves confluent in a broad flap, free on the hind margin, reaching the teeth in a rounded prominence; angles rounded. Posterior valves quite rudimentary, absent around the uncovered portion of the nostril, slightly developed in a thin fold back from the middle of the nostril toward the angles of the mouth. Mouth protractile; teeth-bands moderate, semicircular on outer margins; teeth small, each with a prominent acuminate cusp on the inner edge of the crown, in $\frac{25}{25}$ rows

on a thirteen inch specimen. Eyes small. Spiracles larger than the eyes, close behind the orbit, with rudimentary papillae on the margins. Ventrals rounded at outer angles, nearly straight on outer margins. Dorsals subequal, rather pointed, bases wider than the fins; origin of first dorsal little behind the ends of the ventral bases, its distance from the second more than a half length of the base. Caudal longer than deep, vertically truncate. Total length 13, length of disk 6, snout to vent 7 and width of disk $6\frac{3}{4}$ inches.

Rusty brown with irregular small and larger spots, largest along the middle of the back; white beneath.

China.

Narcine indica.

Raia ocellata no. 1 Russell, 1803, Coromandel fishes, **1**, p. 1, pl. 1.
Raia maculata Shaw, 1804, Zool. **5**, pt. 2, p. 316.
Narcine indica Henle, 1834, Ueber Narcine, p. 35, pl. 2, f. 2; Müller & Henle, 1841, Plagios., p. 130; T. Cantor, 1849, Malay fishes, p. 417; Duméril, 1852, Torpedo, p. 54; 1865, Elasm., p. 517.
Narcine maculata Duméril, 1852, Torpedo, p. 35; 1865, Elasm., p. 518.
Narcine microphthalma Duméril, 1852, Torpedo, p. 36.
Gonionarce indica Gill, 1861, Ann. N. Y. lyc., **7**, p. 387.
Narcine timlei Günth., 1870, Cat. fishes Brit. mus., **8**., p. 452.

Disk about half the total length, subovate, broader than long, greatest width equal distance from snout to vent. Snout moderate, broadly rounded in front. Anterior nasal valves very short, confluent, reaching the teeth in a median prominence, rounded on the outer angles. Posterior narial valves, in a low fold, reaching the outer side of the nostril; they extend back from the middle in a wider fold toward the angle of the mouth. Mouth small; teeth bands narrow, rounded at their outer ends; teeth small, each acuminate on the inner edge, in $\frac{27}{26}$ rows on a specimen of twelve and one half inches. Eyes small. Spiracles much larger than the eyes, close behind the orbits, without papillae on the edges. Dorsals about equal, upper angles rounded; origin of first dorsal above the ends of the bases of the ventrals, base equal nearly twice the distance from the second. Caudal medium, angles rounded, subcaudal fin rather deeper than in *N. timlei*, hind margin obliquely convex.

Specimen described from Penang. Brown with smaller and larger spots of darker. Cantor gives the colors of others from the same locality as light reddish brown with numerous spots of chocolate color, and says the young have the spots edged with silvery white; whitish beneath. Compared with *N. timlei* this species appears to be broader and less round in the disk, a wider subcaudal gives the appearance of a deeper caudal fin, the dorsals differ slightly in shape and the first dorsal is inserted farther forward.

Narcine timlei.

Plate **61**, fig. 6.

Raja timlei Schneider, 1801, Bloch Ichth., p. 359.
Raia ocellata no. 2 Russell, 1803, Coromandel fishes, **1**, p. 2, pl. 2.
Raia bicolor Shaw, 1804, Zool., **5**, pt. 2, p. 316.
Torpedo timlei Olfers, 1831, Torpedo, p. 22.
Narcine timlei Henle, 1834, Ueber Narcine, p. 34, pl. 2, f. 1; Müller & Henle, 1841, Plagios., p. 130; Richardson, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 196; Gray, 1851, Chondropterygii, p. 102; Duméril, 1852, Torpedo, p. 33; 1865, Elasm., p. 518; Bleeker, 1853, Nat. tijds. Ned. Ind., **4**, p. 512; Kner, 1867, Nov. fische, p. 417; Day, 1878, Ind. fishes, p. 733 (part); Jord. & Seale, 1905, Proc. Davenport acad., **10**, p. 2, pl. 1.
Narcine macrura Duméril, 1852, Torpedo, p. 37.
Cyclonarce timlei Gill, 1861, Ann. N. Y. lyc., **7**, p. 387.

Disk subcircular, little less than half the total length, little wider than long. Anterior narial valves short, confluent in a broad flap reaching the mouth, with two slight notches and three low prominences on the hind border; posterior valves feeble, extending to the outer side of the nostril, continued in a slight fold toward the angle of the mouth. Mouth small protractile; bands of teeth narrow, rounded on outer margins of $\frac{23}{21}$ rows on an eleven inch specimen, each tooth with an acuminate point on the inner edge of the crown. Eyes small; spiracles much larger, close behind the orbit, without papillae on the edges. Dorsals subequal, upper angles pointed; origin of first dorsal a short distance behind the ends of the bases of the ventrals. Ventrals rather narrow, nearly straight or slightly concave on the hind margin, outer angles distinct. Caudal depth about two thirds of its length, lower margin broadly rounded, hind margin oblique, somewhat convex.

Specimen described reddish brown, or brownish red, with numerous darker spots on the back; whitish below.

China. Also reported from the East Indies and Japan.

Narcine brunnea.

Narcine timlei Day, 1878, Ind. fishes, pl. 192, f. 3; 1889, Fauna Brit. India, **1**, p. 45, f. 18.
Narcine brunnea Annandale, 1909, Mem. Ind. mus., **2**, p. 45, pl. 3A, f. 2.

This species is known from the original description and from the figure by Day. Annandale says it is closely allied to *N. timlei* but is distinguished by uniform coloration, by size, by forms of teeth, and by the ridges in the mouth. Specimens of 8.66 inches in length (22 cm.) are said to be large. Adult specimens of *N. timlei* are given 13.38 inches (34 cm.) in total length. Day's figure gives

N. brunnea sharper angles on ventrals dorsals and caudal than exist on other species of the genus.

Back warm chocolate-brown, without spots, margins of disk and edges of fins light; lower surfaces creamy white.

Off the coasts of India.

Narcine firma, sp. nov.

Disk subovate, wider than long, narrowing from opposite the gill apertures. Snout long, broadly rounded in front. Nostrils near the mouth; anterior valves short, confluent in a broad flap with three prominences on the hind margin, median larger, and with a shallow notch on each outer edge a short distance in front of the corner; posterior valves better developed than those of *N. brasiliensis*, fold wider behind the nostril and passing along the hinder half of the outer side of the nostril; from the projection into the nostril it passes back into the longitudinal fold curving backward outside of the angles of the mouth but distinct from that going completely around the jaws. Mouth small, protractile; teeth bands narrow, about half the width of the mouth, posterior ending in a right angle, rows on a seventeen inch male specimen $\frac{23}{22}$, each tooth with a strong acuminate cusp on the margin toward the cleft, inward. Eyes very small. Spiracles larger than the eyes, without papillae on the edges. Ventrals rather narrow, triangular, outer angle blunted; claspers short, depressed, blunt. Dorsals subequal, base of first dorsal about equal its distance behind the ends of the ventral bases, or twice its distance from the second dorsal; base of second dorsal longer. Tail, from vent, one half of the total length or little more, depressed, strong, with lateral folds from the middle of the first dorsal. Caudal less than twice as long as deep; subcaudal portion narrow, obliquely rounded; supracaudal longer, somewhat pointed. Total length 17, length of disk $7\frac{5}{8}$, snout to vent $8\frac{1}{4}$, and width of disk $8\frac{1}{4}$ inches.

Colors too faded for description.

The rostrum is stouter than in any other species of the genus; the snout is broad shovel-shaped, and the pectorals end opposite the eyes.

Colombo, Ceylon. Capt. Putnam.

Narcine tasmaniensis.

Narcine tasmaniensis Richardson, 1841, Proc. Zool. soc. London, pt. 9, p. 22; Trans. Zool. soc. London, **3**, p. 178, pl. 11, f. 2; Duméril, 1865, Elasm., p. 517; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 452; Waite, 1899, Mem. Austr. mus., **4**, p. 41.

Disk a broad ovate, narrowed anteriorly, broader than long. Tail equal the distance between mouth and vent. Anterior nasal valves confluent in a broad flap with angles rounded and a median prominence toward the teeth; posterior valves with an obtuse lobed fold on the outer side of each nostril. Mouth small, protractile; teeth bands narrow, angular on the outer margins; each tooth with an acute point on the inward margin of the crown. Dorsals subequal, tips rounded; origin of first dorsal above the ends of the ventrals. Caudal longer than deep, angles rounded, hind margin oblique, convex.

Reddish brown, sides of tail and lower front margins of disk yellowish; lower surfaces and claspers white.

Tasmania; Australia.

Narcine mollis.

Narcine mollis Lloyd, 1907, Rec. Ind. mus., **1**, p. 8; Annandale, 1909, Mem. Ind. mus., **2**, p. 43, pl. 3A, f. 3, 3ª; Lloyd, 1909, Mem. Ind. mus., **2**, p. 144; 1909, Ill. zoöl. Investigator, Fishes, pl. 46, f. 1, 1ª.

Especially distinguished by elongated nasal valves, the length of the anterior being nearly equal to the width between the nostrils. Posterior valves well developed, not reaching the mouth. Disk subcircular, length little less than width. Length of snout less than twice the internarial width. Eyes small, orbits equal spiracles. Spiracles without papillae, near the orbits. Nasal valves meeting in a prominence in front of the symphysis at the mouth. Fins blunt. First dorsal rather smaller than second, origin above ends of ventral bases. Tail strong, little longer than the body; caudal fin deep, rounded on the angles, convex on the hind margin.

The type apparently was a very young specimen; it was taken in the Gulf of Aden, at 130 fathoms.

Brown, dark above, greyish below.

Discopyge.

Discopyge Tschudi, 1845, Fauna Peruana, Pisces, p. 32.

Disk circular, about half the total length; preoral section short. A large electric organ between head and each pectoral. Mouth protractile, small. Teeth bands narrow; teeth small, numerous, inward angle acute. Nostrils small, near the mouth; anterior valves confluent, reaching the mouth, free-margined at sides and ends. Eyes small. Spiracles larger than the eyes, at a short distance behind them, not fringed. Gill openings narrow. Tail distinct,

with two dorsals, a well-developed caudal and with lateral folds. Ventrals large, united below the tail. Skin naked.

Coast of Peru.

Discopyge tschudii.

Discopyge tschudii Tschudi, 1845, Fauna Peruana, Pisces, p. 32, pl. 6; Duméril, 1865, Elasm., 521; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 454.

Disk circular; tail less than half the total length. Mouth, eyes, and spiracles in the anterior seventh of the total. Mouth small, protractile; teeth bands narrow; teeth minute, flat, inner margins acute angled. Eyes small. Spiracles much larger than the eyes and at a short distance backward, margins without papillae or projections. Gill apertures small, hindmost two behind the middle of the disk. Dorsals small, rounded, subequal; origin of first dorsal slightly in front of the hind margin of the ventrals; second dorsal reaching little beyond the origin of the caudal. Ventrals broad, rounded, united behind the vent. Tail small, depressed, dermal folds prominent, posterior margin of caudal convex, supracaudal portion of fin longer.

Dusky reddish brown above, darker over the middle; dull whitish below.

Specimen described about five and five eighths inches long taken between Huacho and Chancay, Peru.

Discopyge ommata.

Discopyge ommata Jordan & Gilbert, 1890, Proc. U. S. nat. mus., **12**, p. 151; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 78.

Disk subcircular, little wider than long. Snout broadly rounded. Eye small. Spiracle close behind the eye, smaller, fringed with eight to ten papillae. Anterior nasal valves confluent. Teeth flat, crown with an angle on inward edge. Dorsals small, subequal, second narrower and higher, rounded. Ventrals large, rounded, united below the tail. Tail shorter than the body cavity, a fold at each side, caudal rounded.

Brown, irregularly mottled and spotted with lighter and darker markings, more distinct near margins of disk and tail; a large ocellate spot of blackish in the centre of the disk. Dorsals and caudal pale marbled with darker brown.

Coast of Panama.

Hypnarce.

Hypnos Duméril, 1852, Rev. & mag. zool., p. 277.
Hypnarce Waite, 1902, Rec. Austr. mus., **4**, p. 180.

Disk longer than broad; preoral region short. Tail short, with two small dorsals and a small caudal. Ventrals large, united. Mouth moderate, not

protractile; teeth bands rather wide, resembling those of Narcacion rather than those of Narcine; teeth small, numerous, tricuspid. Eyes small. Spiracles large, close behind the eyes, fringed. Gill openings small. A large electric organ between the head and each pectoral. Dorsals small, above the ventrals. Vent far behind the middle of the total length.

Hypnarce subnigrum.

Hypnos subnigrum Duméril, 1852, Rev. & mag. zool., p. 279, pl. 12; 1865, Elasm., p. 520; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 453.
Hypnarce subnigrum Waite, 1899, Mem. Austr. mus., **4**, p. 42; 1902, Rec. Austr. mus., **4**, p. 180.

Disk longer than wide, broader forward, rostral region short. Mouth and eyes in the anterior sixth of the length. Spiracles larger than the eyes, borders fringed. Mouth and bands of teeth of moderate width; teeth small, narrow, with three slender, acute cusps. Ventrals elongate, broad, rounded, united below the tail. Dorsals subequal, close together above the hinder half of the ventrals. Tail less than a fourth of the total length. Skin naked, smooth.

Waite mentions a specimen of two feet three inches in length.

Young blackish brown; large specimens taken by Waite were of a rich yellowish brown color.

Sydney, New South Wales; West Australia.

Narcacion.

Narcacion Klein, 1742, Hist. pisc., miss., **3**; 1777, Neuer schaupl., **4**, p. 726; Walbaum, 1792, Artedi, p. 580; Gill, 1862, Ann. N. Y. lyc., **7**, p. 387.
Torpedo Houttuyn, 1764, Nat. hist., **6**, p. 453; Duméril, 1806, Zool. anal., p. 102.
Tetronarce Gill, 1861, Ann. N. Y. lyc., **7**, p. 387.
Gymnotorpedo Fritsch, 1886, Arch. physiol., p. 365.
Fimbriotorpedo Fritsch, 1886, Arch. physiol., p. 365.

Disk wider than long, subcircular; snout short, weak, flexible; tail distinct, short, with two dorsals, a well-developed caudal fin, and a low keel on each side. Ventrals not united, anteriorly below the pectorals. Mouth crescentic, with a longitudinal fold at each angle. Nostrils small; anterior valves united, forming a broad flap in front of the mouth, free behind and at the sides. Teeth small, in pavement; broad-based, crown with an acute angle directed inward. Spiracles moderate, at a short distance behind the eyes, with or without fringes on the margins. Rostral cartilage weak, short, reduced to a pair of slender rods.

Tropical and temperate seas.

Spiracles fringed, on young

base of the first dorsal half above the bases of the ventrals

marmorate . . . . . *marmoratus* (page 305)

ocellate, rarely unspotted . . . . *torpedo* (page 306)

base of first dorsal wholly above bases of ventrals

base of dorsal ending in front of bases of ventrals

brown with mottlings and spots of light and dark *panthera* (page 307)

spots ocellate . . . . . *suessi* (page 308)

spots small or absent . . *fuscomaculatus* (page 308)

base of dorsal and bases of ventrals ending even

brown with irregular large spots and small ones *sinus-persici* (page 309)

Spiracles not fringed

base of first dorsal and bases of ventrals ending even *fairchildi* (page 310)

base of first dorsal half above bases of ventrals . *nobilianus* (page 310)

base of first dorsal above ends of bases of ventrals . *californicus* (page 311)

base of first dorsal with less than half its base above the ventrals *tokionis* (page 312)

Narcacion marmoratus.

Plate **61**, fig. 1–3 (embryos); Plate 67, fig. 1–2.

Narce Belon, 1553, Aquat., p. 90.

Torpedo Belon, 1553, Aquat., p. 90.

Torpedo tertia et quarta Rondelet, 1554, Pisc., p. 90.

Torpille Reaumur, 1714, Mem. Acad. sci. Paris, p. 344, pl. 12, f. 1, pl. 13, f. 2; Duhamel, 1782, Traité, **4**, p. 282, pl. 13.

Narcacion Klein, 1742, Hist. pisc., miss., **3**, p. 32, no. 3, 4.

Raia torpedo Linné, 1758, Syst., **1**, p. 231 (part).

Torpedo Walsh, 1773, Philos. trans., **63**, p. 461, pl. 19; Hunter, 1773, Philos. trans., **63**, p. 481, pl. 20; Pringle, 1775, Discourse on the Torpedo; Cavendish, 1776, Philos. trans., **66**, p. 196.

Electric ray Pennant, 1776, Zool., **3**, p. 78, pl. 10, no. 36; Yarrell, 1836, Brit. fishes, **2**, p. 410.

Torpedo marmorata Risso, 1810, Ichth. Nice, p. 20, pl. 3, f. 4, 1826, Hist. nat., **3**, Poissons, p. 143, f. 9; Olfers, 1831, Torpedo, p. 14; Henle, 1834, Ueber Narcine, p. 30; Müller & Henle, 1841, Plagios., p. 128; Duméril, 1852, Rev. & mag. zool., p. 236; 1865, Elasm., p. 508, Günth., 1870, Cat. fishes Brit. mus., **8**, p. 450; Garman, 1888, Bull. M. C. Z., **17**, p. 92, pl. 32; Fritsch, 1886, Arch. physiol., p. 367; Sauvage, 1891, Poiss. Madagascar, p. 2.

Torpedo galvani Risso, 1810, Ichth. Nice, p. 21, pl. 3, f. 5; 1826, Hist. nat., **3**, Poissons, p. 144; Bonaparte, 1841, Icon. Fauna Ital., Pesci.

Torpedo vulgaris Fleming, 1828, Brit. anim., p. 169.

Torpedo diversicolor Davy, 1834, Philos. trans., **2**, p. 550; 1839, Researches, **1**, p. 79.

Torpedo picta Lowe, 1843, Proc. Zool. soc. Lond., p. 93.

Torpedo trepidans Valenciennes, 1843, Ichth. Canar., p. 101; Duméril, 1852, Rev. & mag. zool., p. 238; 1865, Elasm., p. 511.

Torpedo hebetans Valenciennes, 1843, Ichth. Canar., pl. 23, f. 2.

Disk subcircular, little wider than long. Snout short, subtruncate, more convex in young. Nostrils small; anterior valves confluent, forming an upper lip with rounded or blunted angles; outer section of posterior valves curved forward at the outer side of the nostril, inner section turned backward toward the angle of the mouth. Mouth small, crescentic; teeth small, in $\frac{22}{20}$ rows on a six inch specimen, in $\frac{28}{26}$ rows on an adult male of nine and one half inches, crown with an acute point. Spiracles nearly as large as the eyes, most often with seven papillae on the margin; of which the anterior two and the fourth are commonly the larger. Dorsals small, rounded; first dorsal not twice as large as the second, with half of its base above the bases of the ventrals. Tail short about one third of the total length, or half that of the body cavity. Caudal axis slightly raised, fins nearly equal, subtruncate.

Back rusty brown, spotted with darker brown or with white, or with both brown and white; in cases nearly or quite uniform brown. White beneath, except under edges of fins and disk; sometimes with scattered blotches of brown.

Total length $9\frac{1}{2}$, body cavity $6\frac{1}{4}$, tail $3\frac{1}{4}$, width 6, and length of disk $5\frac{1}{2}$ inches.

Mediterranean Sea and Eastern Atlantic.

Narcacion torpedo.

Νάρκη, Aristotle, Hist. anim., II, c. ix, 3; II, xi, 7; vi, c. x, 7, 9; ix, c. xxv, 2.

Torpedo Pliny, Historia, book ix, chap. 42; Jovius, 1524, Romanis piscibus, c. 28; Wotton, 1552, Diff. anim., f. 145.

Torpedo oculata Belon, 1553, Aquat., p. 92, fig.

Narcacion torpedo Klein, 1742, Hist. pisc., miss., **3**, p. 31; 1777, Neuer Schaupl., **4**, p. 726, 733; Walbaum, 1792, Artedi, p. 580 (part).

Raia torpedo Linné, 1758, Syst., **1**, p. 231 (part); 1776, Syst., **1**, p. 395; Brunnich, 1768, Ichthy. Massiliensis, p. 1; Bloch, 1785, Ausl. fische, **1**, p. 44, pl. 122; Gmelin, 1788, Syst., **1**, p. 1504; Blumenbach, 1810, Abbild. nat. gegenstände, no. 57; Geoffroy, 1892, Ann. mus., **1**, p. 392, pl. 26, f. 1.

Cramp fish Brookes, 1763, Nat. hist., **3**, p. 43.

Cramp ray Pennant, 1769, Zool., **3**, p. 67.

Raia torpedo Müller, 1774, Linné natursystem, **3**, p. 237.

Torpedo narke Risso, 1810, Ichth. Nice, p. 18; 1826, Hist. nat. **3**, Poissons, p. 142; Cuv., 1817, Reg. anim., **2**, p. 134; Bonaparte, 1841, Icon. Fauna Ital., Pesci.

Torpedo unimaculata Risso, 1810, Ichth. Nice, p. 19, pl. 3, f. 3; 1826, Hist. nat. **3**, Poissons, p. 143, pl. 4, f. 8; Cuv., 1817, Reg. anim., **3**, p. 134.

Torpedo ocellata Rudolphi, 1821, Grund. phys., **1**, p. 199; Olfers, 1831, Torpedo, p. 9, pl. 1, f. 3; Henle, 1834, Ueber Narcine, p. 30; Fritsch, 1886, Arch. physiol., p. 367.

Raia narce Nardo, 1827, Prod. Adriat. Ichthy., p. 8, no. 4; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 449.

Torpedo oculata Davy, 1829, Philos. trans., p. 15; 1832, Philos. trans., p. 259; 1839, Researches, **1**, pl. 1–12; Müller & Henle, 1841, Plagios., p. 127; Duméril, 1852, Rev. & mag. zool., p. 234; 1865, Elasm., p. 506.

Torpedo (*Eunarce*) *narke* Fowler, 1910, Proc. Acad. nat. sci. Phil., **62**, p. 472.

Disk wider than long broadly rounded. Snout short, slightly concave in front. Nostrils small, wider than the space between them; anterior valves

joined in a quadrangular flap free on the margin, forming an upper lip; posterior valves curving forward on the outer side of the nostril and in the inner section turning back toward the angle of the mouth. Mouth moderate, with a longitudinal fold at each angle; teeth small, with an acute cusp, in $\frac{23}{26}$ rows on a nine inch specimen and on one of twelve inches and a half in $\frac{34}{32}$ rows. Eye small less than one third of the length of the snout. Spiracle larger than the eye, with rudimentary fringes, 3–7, more distinct on the young, apparently disappearing on the old. Dorsals small, rounded; anterior dorsal nearly twice the size of the posterior, with the forward half of its base above the bases of the ventrals; base of second dorsal less than its length from that of the first. Tail short, about four ninths of the total length, origin of lateral folds about opposite that of the first dorsal; caudal about as deep as long, upper lobe slightly the longer.

Brown more often with five ocellate black spots at the angles of a pentagon in cases with more or varying to but one or, rarely, to none. Some individuals have small spots of white more or less symmetrically arranged, others are clouded, blotched, or spotted with dark and with light.

Total length of specimen in hand 9, length of disk $4\frac{3}{8}$, width of disk 5, and length of body cavity $5\frac{1}{4}$ inches.

Mediterranean and the neighboring Atlantic.

Narcacion panthera.

Torpedo marmorata var. γ, *panthera* Olfers, 1831, Torpedo, p. 15, 16.
Torpedo marmorata var. c. Henle, 1834, Ueber Narcine, p. 30.
Torpedo panthera Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 68, pl. 19, f. 1; Müller & Henle, 1841, Plagios., p. 193; Duméril, 1865, Elasm., p. 510; Günth., 1870, Cat. fishes Brit. mus., 8, p. 451.

Disk subcircular, wider than long. Snout short, length greater than width of mouth, nearly straight across the front. Mouth medium, with a longitudinal fold at each angle. Teeth small, broad-based, crown with a slender acute cusp, rows $\frac{37}{36}$ on a specimen of ten and one fourth inches. Eye very small, about one fifth of the length of the snout. Spiracles larger than the eye, fringed irregularly, about three diameters from the eyes; papillae of the fringes five or six, posterior one larger. Dorsals small, with blunted inner angle, upper extremity rounded; origin of first dorsal above the end of the vent, end of base in front of the ends of the bases of the ventrals; origin of second little behind ventral bases. Tail hardly more than one third of the total length, small, weak,

depressed, with a low fold on each side from opposite the second dorsal. Caudal deeper than long, rounded, hind margin slightly convex.

Rusty brown, with spots varying from lighter brown to white, and from larger than the spiracle to minute dots, so closely placed that the brown appears as narrow streaks, reticulations, bars, and spots. Lower surfaces white, except the edges, which are mottled and spotted with white and brown. Hinder margins of dorsals and caudal light.

Total length of specimen described $10\frac{1}{4}$, length of disk 6, length of body cavity $6\frac{5}{8}$ and width of disk 6 inches.

In the type the number of rows of teeth are said to be $\frac{40}{26}$ which is probably abnormal.

Red Sea.

Narcacion suessi.

Torpedo suessi Steindachner, 1898, Sitzb. Akad. wiss. Wien., **107**, p. 784, pl. 2.

Disk subcircular; snout slightly convex. Spiracles fringed; papillae five or more, irregular, hindmost one largest. Tail shorter than the body; caudal angles rounded, margins convex; folds originating opposite the second dorsal. Dorsals rounded; first dorsal not twice as large as the second, origin above the vent, end of base in front of the ends of the bases of the ventrals; origin of second dorsal in front of the free ends of the ventral fins.

Brownish, mottled anteriorly, with large spots of blackish edged with white, eight or more on the disk and one on the base of each of the dorsals and the ventrals. Spots varying in diameter from the width of the mouth to very small dots.

Perim and Mocha, Red Sea.

Closely allied to if not identical with *N. panthera*.

Narcacion fuscomaculatus.

Torpedo fuscomaculatus Peters, 1855, Monatsb. Berl. akad., p. 466; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 451.
Narcacion polleni Bleeker, 1866, Nat. tijds. Ned. Ind., **3**, p. 171; 1874, Faune Madagascar, p. 1, pl. 1.
Torpeda panthera Klunzinger, 1871, Syn. fische, **2**, p. 238.

Disk broader than long. Snout subtruncate. Mouth wide, with a longitudinal fold at each angle. Teeth small, broad-based, sharp-cusped, in $\frac{64}{62}$ rows on an eighteen inch specimen, while an eight inch individual apparently of the same species has $\frac{31}{30}$ rows. Eye small, about twice the length of the orbit from the spiracle. Spiracles larger than the eye; fringes small, four on the inner

border, fifth largest. On the small specimen the fringes are very distinct, on the large they are more or less rudimentary. Dorsals small, rounded; first dorsal much the larger, origin above the vent, end of base in front of the ends of the bases of the ventrals; base of second about three fifths the length of the base of the first. Tail nearly one third of the total length. Caudal little longer than deep on a large individual, deeper than long on a small one, hind margin convex; subcaudal very little shorter; caudal folds low beginning opposite the middle of the second dorsal.

Brown, rusty, or yellowish, with numerous spots or streaks of darker and of lighter and with some spots of black.

Total length 18, length of disk 10, length of body 12, and width of disk $13\frac{3}{4}$ inches.

Specimen described from Mauritius; originally described from Mozambique, and later, *N. polleni*, from Madagascar.

A close ally of *N. panthera*, possibly a variety.

Narcacion sinus-persici.

?Torpedo sinus-persici Kaempfer, 1712, Amoen. exot., **3**, p. 509; Valent., 1720, Amph. zoot., **2**, p. 115, pl. 69.
Torpedo marmorata var. δ., *T. sinus-persici* Olfers, 1831, Torpedo, p. 15; Henle, 1834, Ueber Narcine, p. 31; Müller & Henle, 1841, Plagios., p. 128.
Torpedo sinus-persici Duméril, 1852, Rev. & mag. zool., p. 239; 1865, Elasm., p. 509; Sauvage, 1891, Poiss. Madagascar, p. 3, pl. 1.
Torpedo smithii Günth., 1870, Cat. fishes Brit. mus., **8**, p. 451.

Disk broad, subcircular. Snout short, length greater than width of mouth, slightly convex in front. Nostrils small, as wide as the space between them, anterior valves confluent in a broad flap reaching the mouth, angles rounded; outer section of posterior valves turned forward on the outer side of the nostril, inner section turned back toward angle of mouth. Mouth moderate, with a longitudinal fold at the angle. Teeth small, broad-based, with medium sized sharp and slender cusps, in about $\frac{28}{30}$ rows. Eye small. Spiracle little larger than the eye, with seven papillae (the fourth of which is the largest), distant from the orbit about two diameters. Dorsals small, narrow, rounded, without an inner angle between inner and hind margins; first dorsal not twice as large as second, origin little behind the vent, base ending about even with bases of ventrals; length of base of second more than distance from first. Tail short, small, with a stout fold on each side from opposite the middle of second dorsal. Caudal deeper than long, subtruncate, angles rounded.

Rusty brown with irregular spots of dark and of lighter, as large as the

spiracles, or larger, to minute scattered over the upper surfaces. Lower surfaces white, darker below edges of disk and fins.

Total length $13\frac{1}{2}$, length of disk 8, length of body $8\frac{3}{4}$, and width $8\frac{1}{2}$ inches.

South Africa?; Persian Gulf.

Narcacion fairchildi.

Torpedo fairchildi Hector, 1872, Fishes of New Zealand, p. 83, pl. 12, f. 134.
Torpedo fusca Parker, 1884, Trans. N. Z. inst., **16**, p. 283, pl. 22, f. 1.

Spiracles not fringed, one diameter behind the eyes. First dorsal above the ventrals, posterior edges of both in a line, size about one and one half times that of second dorsal. Tail shorter than the body. Total length thirty-four inches, width twenty-four.

Uniform grayish black above, whitish beneath.

Napier Harbour, North Island, New Zealand, and Australia.

Narcacion nobilianus.

Plate **25**, fig. 2; Plate **61**, fig. 4–5.

Torpedo nobiliana Bonaparte, 1832, Icon. Fauna Ital., Pesci, fasc. 12; Yarrell, 1836, Brit. fishes, **2**, p. 546; Müller & Henle, 1841, Plagios., p. 128; Duméril, 1865, Elasm., p. 512.
Torpedo walshii Thompson, 1840, Ann. nat. hist., **5**, p. 292; 1856, Nat. hist. Ireland, **4**, p. 256.
Torpedo hebetans Lowe, 1841, Trans. Zool. soc. London, **2**, p. 195; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 449.
Torpedo occidentalis Storer, 1843, Amer. journ. sci., **45**, p. 165, pl. 3; 1846, Mem. Amer. acad., new ser., **2**, p. 264; 1867, Mass. fishes, p. 271, pl. 39, f. 5; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 39.
Torpedo nigra Guichenot, 1850, Expl. Alg., p. 131, pl. 8.
Tetronarce occidentalis Gill, 1861, Ann. N. Y. lyc., **7**, p. 387; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 77.
Torpedo Couch, 1867, Brit. fishes, **1**, pl. 30.

Disk wider than long, broadly rounded at the sides. Snout short, subtruncate. Nostrils small, about half as wide as the internarial space; anterior valves confluent, extending to the mouth as an upper lip, outer edges free, with a low process near the outer angle, representing as a rudiment the middle lobe or section as developed in the Discobatidae and the Rhinobatidae; posterior valve with outer section curving forward along the outer side of the nostril and inner section turning back toward the angle of the mouth. Mouth large, crescentic, width greater than length of snout, a longitudinal groove at each angle. Teeth small, broad-based, crown acute on inner margin, in $\frac{36}{34}$ rows on a twenty-five inch specimen. Eye small. Spiracle larger than the eye, about one diameter behind the orbit, not fringed. Dorsals small, narrow, rounded on the ends; first dorsal with about half its base above the bases of the ventrals;

second dorsal less than half as large as the first, and base longer than the distance from the first. Tail not far from one third of the total length, about nine sixteenths of the length of the body cavity, narrow, depressed, rounded at the sides, with a low dermal fold on each side from opposite the space between the dorsals; caudal axis slightly raised, length about three fourths of the depth, subtruncate.

Dark chocolate-brown on the back and below the edges of disk, fins, and tail; balance of lower surface white.

Total length 25¼, body cavity 16, length of disk 13, and width of disk 17 inches.

Mediterranean Sea to the Western Atlantic.

Bonaparte's figures of *N. nobilianus* have the notched condition of the pectorals seen on fig. 4, and 5 of Plate **61**. Kaempfer's figures of *N. sinus-persici* Duméril exhibit similar notches.

Narcacion californicus.

Plate **53**, fig. 2 (pelvis).

Torpedo californica Ayres, 1855, Proc. Cal. acad. sci., **1**, p. 70; Jord. & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 39, 876; Garman, 1888, Bull. M. C. Z., **17**, p. 93, pl. 31.
Tetronarce californica Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 77.

Disk broader than long, subcircular. Snout short, convex. Nostrils small, not as wide as their distance apart; anterior valves, not long, confluent, forming an upper lip, no lobule present as on *N. nobilianus;* outer section of posterior valve curved forward at the outer side of the nostril, inner section turned backward toward the angle of the mouth. Mouth wide, crescentic, with a fold at each angle. Teeth small, broad-based, inner edge of crown with a slender acute cusp, in $\frac{28}{26}$ rows on a thirteen inch individual. Eyes small. Spiracle larger than the eye, less than one diameter farther back, without fringes. Dorsals small, rounded; anterior dorsal twice as large as the posterior, base entirely above ends of bases of ventrals; second dorsal one length of its own base farther back than the base of the first. Tail short, with a low fold on each side from opposite the space between the dorsals. Caudal large, deeper than long, with angles rounded, subtruncate.

Brown, edges of dorsals light; lower surfaces white, outer edges brown.

Total length of specimen described 13, length of disk 7½, length of body 8¼ and width 9½ inches.

California.

Torpedo chilensis Guichenot 1848, Fauna Chilena, **2**, p. 368, is insufficiently described: — "*Torpedo corpore omnino rotundato, fusco-nigricante.* La forma de esta especie es perfectamente redondeada.— Color: moreno rojizo, tirando algo al de ladrillo, pero mas oscuro.— Longitud total, nuestro dibujo la representa de 2 piés; su mayor anchura es de 10 á 11 pulg.; sin embargo, suele ser mucho mayor."

Narcacion tokionis.

Tetronarcine tokionis Tanaka, 1908, Journ. Coll. sci., Tokyo, **23**, p. 2.

This species appears to be shaped much like *N. californicus* but somewhat narrower in disk and longer in the tail. The hind margin of the caudal is indented; the first dorsal is more than twice as large as the second and has less than half of its base above the ventral bases.

Uniform brown above; whitish beneath.

Sagami Sea, Japan.

Narke.

Narke Kaup, 1826, Arch. anat. phys., p. 365; 1836, Thierreich, **3**, p. 113.
Astrape Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117.
Bengalichthys Annandale, 1909, Mem. Ind. mus., **2**, p. 46.

Head, body, electric organs, and pectorals united in a subcircular disk. Anterior narial valves confluent in a quadrangular flap, free behind, covering the mouth. Mouth small, protractile, surrounded by a fold. Teeth small, in narrow bands. Eyes small, protruding. Spiracles larger than the eyes, immediately behind the orbits, with smooth, raised edges. Gill openings narrow. Ventrals broad, distinct, inserted below the pectorals. One dorsal. Tail short, with a fold at each side; caudal resembling that of Rhinobatus, supracaudal longer. Skin soft, smooth, naked.

Base of dorsal above the ventrals
  vent behind the middle of total length . . *capensis* (page 313)
Base of dorsal behind the ventrals
  vent near the middle of the total length
    ventrals with an outer angle, margin excavated
      brown above, with white spots and edges, white beneath
        dipterygia (page 313)
    ventrals lacking outer angle, margin rounded
      brown above and beneath, plain or spotted with black and white
        japonica (page 314)

ventrals blunted on outer angles, margin sinuous
brown above, light spots; cream below; eyes minute
impennis (page 315)

Narke capensis.

Raia sp. Gronow, 1763, Zoophy, **1**, no. 152, p. 35.
Raia capensis Gmelin, 1789, Linné Syst., **1**, p. 1512; Schneider, 1801, Bloch Ichth., p. 360.
Torpedo capensis Olfers, 1831, Torpedo, p. 23; Gray, 1854, Gron. syst., p. 13.
Narcine capensis Henle, 1834, Ueber Narcine, p. 36, pl. 3, f. 1.
Astrape capensis Müller & Henle, 1841, Plagios., p. 130; Gray, 1851, Chondropterygii, p. 108; Duméril, 1852, Rev. & mag. zool., p. 280; 1865, Elasm., p. 522; Kner, 1867, Nov. fische, p. 419; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 454.

Disk wider than long, transversely elliptical, curve in front of snout very broad. Nostrils and valves, mouth, eyes, and spiracles similar to those of *N. dipterygia*. Teeth bands of moderate width, intermediate between those of Narcacion and those of Narcine. Vent behind the middle of the total length. Ventrals broad, broadly rounded on the outer margin, less angular than those of *N. dipterygia*, claspers short, depressed, very blunt. Dorsal small, rounded, base entirely above the ventral. Caudal of medium size, subcaudal the shorter and broadly rounded.

Colors variable; back uniform dusky brown, or brown with whitish spots; lower surface white more or less spotted with brown.

Cape of Good Hope; Madagascar.

Narke dipterygia.

Raia dipterygia Schneider, 1801, Bloch Ichth., p. 359.
Torpedo dipterygia Olfers, 1831, Torpedo, p. 25, pl. 2, f. 2.
Narcine dipterygia Henle, 1834, Ueber Narcine, p. 38.
Astrope dipterygia Müller & Henle, 1841, Plagios., p. 131; T. Cantor, 1849, Malay fishes, p. 419; Gray, 1851, Chondropterygii, p. 103; Duméril, 1852, Rev. & mag. zool., p. 42; 1865, Elasm., p. 523; Day, 1865, Fishes Malabar, p. 276; 1878, Ind. fishes, p. 734, pl. 192, f. 4; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 454.

In most respects closely resembling *Narke japonica*. Distinguished by the ventral fins and the coloration. Disk subcircular; tail little longer. Base of dorsal midway from the bases of the ventrals to the origin of the caudal. Ventrals with an outer angle more or less prominent and with an indented outer margin. In coloration individuals vary to a considerable extent. Cantor describes one that was dark greenish olive above, with a large round whitish spot on each side at the posterior margin of the disk; anterior half of the ventrals whitish; a large round whitish spot above the end of each ventral, and a similar one at each side of the root of the caudal; dorsal and caudal blackish brown or black; beneath whitish. Day figures another of a dull reddish olive above,

whitish below, with white margins to disk, ventrals, tail and spiracles, and with a white spot of some size above each pectoral near its end. In general it may be said the back is dusky brown, uniform or white-spotted, and the lower surface white with brown blotches or spots.

Originally described from Tranquebar; other localities given are Penang, Singapore, Malay Peninsula, Lancavy Islands, Malacca, Hindostan, Canton.

Narke japonica.

Plate **24**, fig. 3; Plate **56**, fig. 10; Plate **67**, fig. 3–4.

Torpedo (*Astrape*) *japonica* Schlegel, 1850, Jap. Pisces, p. 307, pl. 140.
Astrape japonica Jordan & Fowler, 1903, Proc. U. S. nat. Mus., **26**, p. 656; Ishikawa & Matsuura, 1897, Cat. fishes, p. 60.

Disk subcircular; snout short, convex on anterior margin. Nostrils small; anterior valves confluent, free behind the median attachment and extending back over the teeth; posterior valves with prominent free margins, curving back at the outer side of the nostrils then turning in and forward as a partition across the interior. Mouth small, protractile, surrounded by a fleshy lip, included by a deep fold of the skin and divided on both jaws by a prominence in the middle of each jaw. A flattened papilla, commonly lobed at its extremity, stands above the middle of each band of teeth. Teeth small, with a sharp angle rising inward from each crown, in $\frac{15}{16}$ rows on an adult male of ten and one half inches; lateral series from each side meeting in an angle in front of each band. Eyes very small, prominent. Spiracles larger than the eyes, immediately behind the orbits, with a smooth raised border, without papillae. Gill openings small. Dorsal fin small, rounded; base little more than its length behind the bases of the ventrals and about the same distance from the origin of the caudal. Tail short, length about half of the total, stout, depressed, with a well-developed caudal and with a fold on each side originating opposite the origin of the dorsal. Subcaudal broadly rounded; supracaudal longer, rounded on the hind margin. Ventrals broad, distinct, convex on the outer margin, without an outer angle; origins below the pectorals; claspers short, depressed, very blunt, with a groove along the upper side and also a short slit near the end. A male of eleven inches is functionally mature; a female of fourteen inches contains fully developed young each of which is three and three fourths inches in length.

Reddish or chocolate-brown above and below, light to very dark, lighter beneath, uniform or spotted with darker, Plate **24**, fig. 3. Some individuals have

small spots of white sprinkled over the ventral surfaces. A frequent marking is white below the anterior ray of each ventral fin. Young at the time of extrusion are nearly uniform, lighter than the adults; they have only the white marks on the first rays of the ventrals. The specimen figured on Plate 24, from the Sagami Sea, differs from most of the others in having black spots on the back and on the lower surfaces.

Specimens described from the Sagami Sea, Japan.

Narke impennis.

Bengalichthys impennis Annandale, 1909, Mem. Ind. mus., **2**, p. 48, f. 9, pl. 3[a], f. 7.

Disk stout, thick, broader forward, length and width about equal, broadly rounded in front. Eyes minute, sunken. Spiracles close to the eyes, edges smooth. Mouth closely resembling that of *N. dipterygia* externally; teeth with the triangular transverse ridge somewhat more pointed than in that species. A somewhat narrow long rectangular process on the roof of the mouth, directed backwards rather than downwards, sinuous on the distal edge; a smaller similar process on the floor of the mouth. Numerous white glandular pits on the back. Pectoral fins a fringed ridge 2–3 mm. broad near the edge of the disk in the posterior half. Tail stout, longer than the disk; caudal angles rounded. Dorsal small, behind the ventrals, near midway to the caudal. Claspers slender, blunt, reaching to origin of dorsal.

Top of disk and tail deep buff clouded with dark brown; lower surface, edges of disk and fins, a large spot behind each battery, another in front of each ventral, and the more elongate blotch behind each ventral and at each side of the base of the caudal cream color.

Length of one of the two types 175 mm., length of disk 81, length of tail 89, greatest width 79, thickness 25, and height or length of dorsal fin 7 mm.

Coast of Orissa, Bay of Bengal.

Temera.

Temera Gray, 1831, Zool. misc., **1**, p. 7.

Disk subcircular, broader than long, longer than the tail. Nasal valves short, confluent, reaching the mouth. Mouth small, protractile; teeth in bands. Eye small. Spiracle moderate, close to the eye, not fringed. Ventrals broad, elongate. No dorsal fin. Tail short. An electric organ between the head and the pectoral. Nearly allied to Narke.

Temera hardwickii.

Temera hardwickii Gray, 1831, Zool. misc., **1**, p. 7; Gray & Hardwicke, 1834, Ill. Ind. zool., **2**, pl. 102, f. 1; Müller & Henle, 1841, Plagios., p. 131, pl. 60, f. 2; T. Cantor, 1849, Malay fishes, p. 420, pl. 12; Duméril, 1852, Rev. & mag. zool., p. 45; 1865, Elasm., p. 524; Bleeker, 1860, Nat. tijds. Ned. Ind., **20**, p. 451; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 455.

Form resembling that of Narke. Disk subcircular, little wider than long, outline less convex in front. Anterior nasal valves confluent, reaching the mouth. Eyes small, in the forward sixth of the disk. Spiracles small, close behind the eyes, not fringed. Mouth small, protractile; dental bands narrow, teeth obtuse (in females). No dorsal fins. Ventrals large, broad, elongate, subtriangular, well developed. Caudal skin smooth, naked.

Six inches in total length.

Uniform brownish, or with darker markings or lighter spots.

Originally described from Penang.

Raiidae.

Body and head much depressed and united with the pectorals forming a rhomboid disk. Tail distinct, depressed, with lateral folds. Dorsals small, behind the mid length of the tail. Eyes and spiracles superior. Mouth inferior; teeth small, numerous, in pavement. Gill-openings inferior, small. Skin generally more or less rough with small sharp spines and larger tubercles. In most, if not all, of the genera the male sex is provided with a group of erectile tenacula near the middle of the upper side of each pectoral. Oviparous. Fossil genera are found in the Upper Cretaceous and later.

Rostral cartilage produced from the skull, pointed
- pectorals widely separated in front
  - ventrals deeply notched
    - dorsals near the end of the tail . . . *Raia* (page 317)
    - dorsals distant from the end of the tail . *Uraptera* (page 367)
- pectorals separated in front, with a lateral process
  - ventrals notched
    - dorsals near the end of the tail . . *Dactylobatus* (page 368)

Rostral cartilage absent or soft
- pectorals somewhat narrowly separated in front
  - ventrals with a shallow notch; caudal rudimentary

Sympterygia (page 369)

Rostrum soft flexible

pectorals narrowly separated behind a short rostral process

Psammobatis (page 370)

Rostral cartilage absent

pectorals notched at the side, close together in snout

Malacorhina (page 372)

Raia.

Raia (part) Linné, 1735, Syst. nat.; Artedi, 1738, Ichthyologia, Syn. p. 99, Gen. p. 70; Linné, 1758, Syst., **1**, p. 231.

Disk subquadrangular to subcircular. Snout more or less produced and pointed, with a stout prolongation from the skull as a rostral cartilage. Pectoral fins widely separated at the snout, not reaching its end. Eyes prominent, with a fimbriate velum above the pupil. Nostrals with two valves, anterior broad reaching the mouth, posterior folded in a tube; a nasoral groove. Mouth transverse nearly straight. Teeth small, tessellate, varying from flat to sharp and pointed. Spiracles close to the eye. Gill-openings small. Caudal membranous. Ventrals notched. Tail with a fold along each side. Fossil in the Eocene and later.

The variation during the life of the individual in length of snout, length of tail, width of disk, dentition, squamation, and coloration, not to mention the variations in the sexes and among the individuals of a species, are so great that it is thought better to group the Raiae according to localities, than to place dependence on a synopsis of species the characters for which are drawn from partial descriptions of single specimens widely diverse in degrees of maturity.

European species . . . . . page 318
Eastern North American species . . . . . page 335
Western North American species . . . . . page 343
Species from Japan to China and India . . . . . page 349
South American species . . . . . page 356
Species from South Africa to New Zealand . . . . page 363

European Species.

Raia radula.

Raia radula Delaroche, 1809, Ann. Mus. hist. nat., **13**, p. 321; Risso, 1826, Hist. nat., **3**, Poissons, p. 151; Müller & Henle, 1841, Plagios., p. 133; Duméril, 1865, Elasm., p. 534; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 461; Moreau, 1881, Poiss. France, **1**, p. 421.
Raia virgata Geoffroy Saint-Hilaire, 1827, Descript. Egypt, **1**, p. 337, pl. 26, f. 2, 3.
Dasybatus radula Bonaparte, 1840, Icon. Fauna Ital., Pesci, p. 487, pl. 64.
Raia atra Müller & Henle, 1841, Plagios., p. 134, pl. 45; Duméril, 1865, Elasm., p. 535; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 461.
Batis radula Bonaparte, 1846, Cat. pesci Eur., p. 12, no. 11.
Raia radula var. *atra* Doderlein, 1884, Man. ittiol. Medit., **3**, p. 210.

Disk rhomboid, subcircular, angles blunt, anterior angle bluntly rounded or subtruncated, forward margins little undulated, outer broadly rounded. Snout slightly produced, short, length little more than the width of the mouth. Mouth nearly straight; teeth blunt, in about 40 rows. Back covered with minute spines; tubercles on the orbital ridge in front of and behind the eye, one on each shoulder, a median vertebral series on back and tail, and with age one or more lateral series on each side of the median on the tail. Lower surfaces nearly smooth.

Greyish to yellowish or reddish brown spotted, streaked, or clouded with darker and lighter; a black ocellus on each shoulder. Varying in individuals to blackish or black.

Mediterranean.

Raia picta.

Raia picta Lacépède, 1802, Poissons, **4**, p. 670, pl. 16, f. 2; Blainv., 1830, Poiss. Fr., p. 33, pl. 4, f. 2.
Raia mosaica Lacépède, 1802, Poissons, **4**, p. 675; Risso, 1826, Hist. nat. **3**, Poissons, p. 154; Blainv., 1830, Poiss. Fr., p. 32.
Raia undulata Lacépède, (non Valmont), 1802, Poissons, p. 675, pl. 14, f. 2; Müller & Henle, 1841, Plagios., p. 134; Duméril, 1865, Elasm., p. 537; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 459; Moreau, 1881, Poiss. France, **1**, p. 438; Doderlein, 1884, Man. ittiol. Medit., **3**, p. 206.

Disk one third wider than long, broad and broadly rounded in the posterior half, very obtuse and rounded in front, anterior margins very slightly concave opposite the spiracles, outer and hinder angles and hinder margins broadly rounded. Snout blunt, tip hardly prominent, rounded. Mouth moderate, arched, width less than two thirds of the length of the snout. Teeth small, unequal, with flattened crowns, rounded on the inner edge, in 41 rows on the upper jaw. Length of orbit little less than the interorbital width, two sevenths

of the length of the snout. Skin nearly smooth, a few small spines on the head, the dorsal fins and the top of the tail. Tubercles with broad swollen striate bases and short compressed and hooked cusps: two in front of and two behind each eye, one on each shoulder, and a median series from head to second dorsal. Young without lateral rows on the tail. Tail longer than the body, produced and acuminate behind the dorsals. Dorsals separated by a space with tubercles.

Light reddish or yellowish brown, with narrow irregular crooked streaks of brown, over the body and extending toward the margins, and apparently with scattered fainter spots of white; white below.

Total length $15\frac{1}{4}$, snout to pores $7\frac{1}{8}$, snout to mouth 2, and greatest width $9\frac{3}{4}$ inches.

There is no apparent reason to doubt that the specimen described above is identical in species with that described and figured by Lacépède as *Raia undulata*. There is some question, however, whether Günther's specimen from Madeira, also a young male, is of the same species; it has 60 rows of teeth and appears to be without the markings.

Raia oculata.

Raia asterias Rondelet, 1554, Pisc., p. 350; Gesner, 1558, Aquat., **4**, p. 934; Aldrovandi, 1613, Pisc. & Cet., p. 457; Willughby, 1686, Pisc., p. 73, pl. C 1, f. 1; Risso, 1826, Hist. nat., **3**, Poissons, p. 153; Müller & Henle, 1841, Plagios., p. 138, 194 (excl. synon.); Duméril, 1865, Elasm., p, 543 (excl. synon.); Günth., 1870, Cat. fishes Brit. mus., **8**, p. 460; Moreau, 1881, Poiss. France, **1**, p. 429; Doderlein, 1884, Man. ittiol. Medit., **3**, p. 180.

Raia oculata Valmont, 1768, Dict. d'hist. nat., **3**, p. 705; Risso, 1826, Hist. nat., **3**, Poissons, p. 149; Fleming, 1828, Brit. anim., p. 172; Müller & Henle, 1841, Plagios., p. 151.

Fuller ray Pennant, 1776, Brit. Zool., **3**, p. 76.

Raia rubus Donovan (non Blainv.) 1803, Br. fish., **1**, pl. 20; Turton, 1806, Syst., **1**, p. 927; Fleming, 1828, Brit. anim., p. 171.

Raia miraletus Donovan (non Linné), 1806, Br. fish., pl. 103; Turton, 1806, Syst., **1**, p. 926; Blainv., 1830, Poiss. Fr., p. 27, pl. 4, f. 1; Jenyns, 1835, Man., p. 518; Yarrell, 1836, Brit. fishes, **2**, p. 431.

Raia fullonica Turton, (non Linné), 1806, Syst., **1**, p. 926.

Raia maculata Montagu (non Duhamel) 1815, Mem. Wern., soc., **2**, p. 426; Jenyns, 1835, Man., p. 514; Parnell, 1838, Mem. Wern. soc. **7**, p. 434, pl. 42, f. 2; Thompson, 1856, Nat. hist. Ireland, **4**, p. 260; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 458; Day, 1884, Brit. fishes, **2**, p. 345, pl. 172.

Homelyn ray Yarrell, 1836, Brit. fishes, **2**, p. 429.

Raia oxyrhynchus White, 1851, Cat., p. 138.

Spotted ray Couch, 1867, Brit. fishes, **1**, p. 104, pl. 24.

Raia brachyura Lafont, 1871, Actes. Soc. Linn. Bord., **28**, p. 503, pl. 25.

Raia blanda Holt & Calderwood, 1895, Trans. Roy. Dublin soc., new ser., **5**, p. 395.

Disk rhomboid, broader than long, front angle very blunt, outer angles nearly 90° anterior margins undulated, hinder angles and margins broadly rounded; snout nearly one fourth of the length of the disk, tip slightly produced and blunted. Width of mouth more than half the distance from the end of the snout. Teeth somewhat pointed in 70–80+ rows. Length of eye less than

two fifths of the snout, nearly equal to width between orbits. Tail little longer than the body, produced behind the second dorsal. Dorsals separated by a space with spines. Back, tail, and lower edges of front margins, rough with small spines. A small tubercle, or more than one, in front of each orbit, in cases one or more behind it; one, sometimes more, on each shoulder; a median vertebral series of tubercles from head to second dorsal is frequently irregular or absent above the body. The variations include from a nearly smooth form to one with a lateral row of tubercles on each side of the tail.

Present specimen of warm brown, profusely spotted with small spots of darker brown and with five or six larger spots of white on the basal portion of the pectorals. Translucent spaces of snout white, immaculate. Variations range from nearly or quite uniform brown to much spotted with brown, to the spotted with white, and to forms marked with large ocellate spots on the bases of the pectorals.

Total length $22\frac{1}{2}$, length of disk 12 and greatest width 16 inches.

Off southern coasts of England to France.

Raia microcellata.

Raia microcellata Montagu, 1815, Mem. Wern. soc., **2**, p. 430; Fleming, 1828, Brit. anim., p. 171; Jenyns, 1835, Man., p. 515; McCoy, 1841, Ann. mag. nat. hist., **6**, p. 407; Müller & Henle, 1841, Plagios., p. 142; White, 1851, Cat., p. 139; Duméril, 1865, Elasm., p. 538; Moreau, 1881, Poiss., France, p. 417; Day, 1884, Br. fishes, **2**, p. 346, pl. 172; Pietschmann, 1906, Ann. k. k. nat. Hofmuseums, **21**, p. 90, pl. 5.
Small-eyed ray Yarrell, 1836, Brit. fish., **2**, p. 433.
Painted ray, Couch, 1867, Brit. fishes, **1**, p. 107, pl. 25.

Disk rhomboid, broader than long, front angle and outer angles greater than 90°, anterior margins nearly straight, hinder border broadly rounded, snout slightly produced, blunt. Mouth wide, width about equal two thirds of its distance from the end of the snout. Teeth flattened in the female, more pointed in the male, in about 55 rows. Eyes small, in diameter equal to one third of their distance apart, or one fifth of that from the end of the snout. Spiracles larger than the eyes. Body and tail rough with small spines, or nearly smooth. A median row of small tubercles on the tail, extending forward on the body in cases, with or without a lateral row at each side.

Greyish or brownish with spots of brownish and of white, larger than the eye, on the middle of the disk, and with narrow stripes near the margins and somewhat parallel with the front and the hinder border. Lower surface white. Reaches a length of more than two feet and a half.

Off shores of southern England and of France.

Raia naevus.

Raia naevus Müller & Henle, 1841, Plagios., p. 138, 194; Duméril, 1865, Elasm., p. 549.
Raia miraletus Couch, 1867, Brit. fishes, **1**, p. 112, pl. 27.

Outlines of disk similar to those of *R. erinacea*, Plate **20**. Width greater than length of body; front angle greater than 90°; snout short one and one half times the internarial space, slightly produced, pointed; outer and hinder angles and outer margins broadly rounded. Mouth waved; teeth sharp (male) in about 54 rows. Rostral cartilage short, pointed, ridges meeting nearly midway from eyes to end of snout. Upper surfaces, top of head, pectorals, and top of tail rough with small sharp hooked spines, longer opposite the sides of the head and on the tail. Three to four compressed hooked tubercles on the orbital ridge in front and as many behind the eye. A median vertebral row of small tubercles on the shoulder girdle is lost behind it but reappears behind the body in a few scattered tubercles. At each side of this row there is a lateral row of which the thorns are larger; it also is interrupted near the girdle. Nearer the lateral folds on the tail there is another lateral row for a considerable distance on each side. Lower surface smooth except below front margin and snout. Male with several rows of tenacula near the outer angle, extending to the front margin on the specimen described. Dorsals distinct but close together. Tail little longer than body, slightly produced behind the dorsals.

Yellowish or rusty brown, with a large spot of black vermiculate or marbled with yellow on the base of each pectoral. The male described has several small spots of dark brown between the eyes and the outer margin. Beneath whitish to flesh color, with a dark spot below the end of the snout.

Described specimen an adult male, from Nice, in total length 20, snout to abdominal pores 9.25, snout to mouth 2.25, and in greatest width 11.75 inches. In size, dentition, etc., it appears more nearly allied to *R. erinacea* than to the larger species, *R. diaphanes*, of the Western Atlantic.

Off Atlantic and Mediterranean Coasts of Europe.

Raia stellata.

Raia asterias Belon, 1553, Aquat., p. 83; Delaroche, 1809, Ann. Mus. hist. nat., **13**, p. 322, pl. 20.
Raia asteria aspera Rondelet, 1554, Pisc., p. 352; Gesner, 1558, Aquat., p. 935; Aldrovandi, 1613, Pisc. & Cet., p. 458; Jonst., 1649, Pisc., p. 36, pl. 10, f. 7; Willughby, 1686, Pisc., p. 73, pl. D 5, f. 4.
Raia stellaris Salviani, 1554, Aquat., f. 150, pl. 51.
Raia stellata Valmont, 1768, Dict. d'hist., nat., **3**, p. 705.

Raia punctata Risso, 1810, Ichth. Nice, p. 12; 1826, Hist. nat., **3**, Poissons, p. 153; Günth., 1870, Cat. fishes Br. mus., **8**, p. 458; Moreau, 1881, Poiss. France, **1**, p. 426; Doderlein, 1884, Man. ittiol. Medit., **3**, p. 186.

Dasybatis asterias Blainv., 1830, Poiss. Fr., p. 26 (part), Bonaparte, 1841, Icon. Fauna Ital., Pesci; Canestrini, 1872, Ital. pesci, p. 57; Perugia, 1881, Pesci Adriatica, p. 58.

Raia schultzii Müller & Henle, 1841, Plagios., p. 138, 194, pl. 47, f. 1; Duméril, 1865, Elasm., p. 541.

Disk rhomboid, broader than long, front angle blunt, outer angles sharply rounded, little if any more than 90°, anterior margins nearly straight, hinder broadly rounded. Snout nearly twice the interspiracular width, tip slightly produced. Mouth somewhat arched; teeth rather flat, in about 38 rows. Rostrum above and below, top of head, middle of back, anterior ends of pectorals and sides of tail rough with small spines. A median row of tubercles on back and tail. Young individuals, and females, rougher and with the spines around the orbits and along sides of tail larger than the others; males with extensive smooth areas above the middle of the pectorals and on the ventrals. Tail longer than the body, produced behind the dorsals. Dorsals separated by a space shorter than the first dorsal.

Reddish brown with numerous small spots of brown; specimen described with a dozen or more larger spots of white, each surrounded by a ring of brown spots on the basal portion of each pectoral, and with five or six similar ones on each ventral. Lower surfaces whitish, a brown spot below the anterior section of each ventral surrounded by the white margin.

Description from a young male taken at Genoa, in total length $14\frac{3}{4}$, snout to pores $6\frac{3}{4}$, snout to mouth 2, and in greatest width $9\frac{1}{8}$ inches.

Southern Europe.

Raia fyllae.

Raia fyllae Lütken, 1887, Vid. medd. nat. foren. Kjök., p. 1, extr. pl. 1; 1898, Danish Ingolf exped., **2**, p. 4, fig., pl. 2; Jordan & Everm., 1896, Bull. 47, U. S. nat. mus., p. 69.

Outlines of the young somewhat like those of *R. plutonia*, Plate **18**, fig. 1, but broader forward. Disk subcircular, snout hardly produced, anterior margins straightened in the middle, front, outer, and hinder angles, and hind margins broadly rounded. Mouth arched, width nearly one and one half times in the length of the snout; teeth in about 30 rows. Orbits large, length greater than the interorbital width, or nearly one and one half times in the preorbital length. Spiracles small. Back roughened with spinules; larger spines above the snout, on the orbital ridge, in a pair on each shoulder, and in a median series from head to dorsals (ca. 37). Tail much longer than the body. Dorsals not separated.

Brown with large spots of darker brown, subsymmetrically arranged, on the back and across the tail.

Type, nearly 8 inches in length, from Davis Straits.

In his later publication Lütken figures an adult male which differs so much from the foregoing as to call for a separate description. Of a specimen 21 inches in total length the outlines bear a considerable resemblance to those of *Malacorhina mira* on Plate **27**, fig. 3, in that the anterior margins are somewhat deeply notched opposite the spiracles. Near the rostral cartilage the outline is concave. The portion of the pectorals opposite the head is narrow while the remainder behind it is very broad and rounded. The snout is short and is produced in a right angle. Back rough along the anterior margins, spines larger opposite the head on the pectorals and on the rostral cartilages; strong spines occur on the orbital ridges and above the spiracles, in a triangular group from the shoulder girdle forward and in a broad band of four or five somewhat irregular series from the girdle backward along the middle of the body and on the top of the tail; smooth below. Teeth in 34 rows. Tenacula of the male numerous and strong.

Back light greyish brown; below brownish.

Apparently a close ally of *R. erinacea*.

Raia quadrimaculata.

Raia quadrimaculata Risso, 1826, Hist. nat., **3**, Poissons, p. 150; Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 65, f. 2; Pietschmann, 1906, Ann. k. k. nat. Hofmuseums, **21**, p. 125, pl. 6.
Raia asterias Couch, 1838, Mag. nat. hist., **2**, p. 72, fig.
Sandy ray Couch, 1838, Mag. nat. hist., **2**, p. 71; fig.; Yarrell, 1839, Brit. fishes. Suppl., p. 69; Couch, 1867, Brit. fishes, **1**, p. 115, pl. 28.
Raia radula Yarrell, 1839, Brit. fishes., Suppl., p. 69; Thompson, 1856, Nat. hist. Ireland, **4**, p. 262.
Raia falsavela Bonaparte, 1841, Icon. Fauna Ital., Pesci, p. 489, pl. 65, f. 1; Duméril, 1865, Elasm., p. 549; Doderlein, 1884, Man. ittiol. Medit., **3**, p. 202.
Raia spinosa Yarrell, 1841, Brit. fishes, ed. 2, **2**, p. 574.
Raia sp. McCoy, 1841, Ann. mag. nat. hist., **6**, p. 405.
Raia circularis Malm, 1857, Öfvers. Vet. akad. Förhl., p. 187; Duméril, 1865, Elasm., p. 536; Collett, 1875, Norges fiske, p. 214; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 462; Day, 1884, Brit. fishes, **2**, p. 348, pl. 174.
Amblyraia circularis Malm, 1877, Göteb. och Bohus fauna, p. 608.

The outlines of this species resemble those of *R. diaphanes* Plate **22**, fig. 1; there is also a considerable resemblance to the small species, *R. naevus*, but the snout is sharper and more projected and the tail is shorter. All of the angles are rounded and the anterior margins are waved. Interorbital width and length of orbit equal. Teeth pointed, in about 80 rows. Back covered with small spines; a series of small tubercles around each orbital ridge. Three to five rows of small tubercles in front of the shoulder girdle, in the middle, the median row of which is continued backward by scattered thorns; the lateral series also are

continued on the tail and are interrupted more or less completely above the abdomen. The median line on the tail is nearly naked.

Rusty brown, uniform or with small darker spots and with or without small dark bordered symmetrically placed spots of white or yellow behind the ends of the girdle, the number of these ocelli varying from one to a dozen or more, as in *R. diaphanes* from the East coasts of the United States. Many individuals, mostly young ones, have a rounded spot of black vermiculated or marbled with yellowish at each shoulder.

A large species reaching a length of more than four feet.

Off the coasts of Europe and Madeira.

Raia miraletus.

Raia aspera stellaris Jonst., 1649, Pisc., p. 36, pl. 10, f. 4.
Raia oculata Willughby, 1686, Pisc., p. 72; Ray, 1713, Pisc., p. 27.
Raia dorso ventroque glabris Artedi, 1738, Ichthyologia, Syn., p. 101, Gen., p. 72, no. 7.
Raia miraletus Linné, 1758, Syst., **1**, p. 231; 1766, Syst., **1**, p. 396; Brunnich, 1768, Ichthy. Massiliensis, p. 2; Bonnaterre, 1788, Ichth., p. 3, no. 4, Gmelin, 1789, Linné Syst., **1**, p. 1507; Walbaum, 1792, Artedi, p. 529; Lacépède, 1798, Poissons, **1**, p. 75; Risso, 1810, Ichth. Nice, p. 4; Rafinesque, 1810, Ind. itt. Sic., p. 47; Risso, 1826, Hist. nat., **3**, Poissons, p. 149; Bonaparte, 1841, Icon. Fauna Ital., Pesci, p. 483, pl. 62; Müller & Henle, 1841, Plagios., p. 141; Duméril, 1865, Elasm., p. 548; Günth., 1870, Cat. fishes Br. Mus., **8**, p. 460.
Raia biocularis Geoffroy Saint-Hilaire, 1827, Descript. Egypt, **1**, pl. 24, f. 2.
Raia quadrimaculata Bonaparte, 1841, Icon. Fauna Ital., Pesci, p. 485, pl. 63.

Disk rhomboid, outlines somewhat resembling those of *R. eglanteria*, of Plate **23**, but snout more produced and pointed, forward margins slightly waved, outer angles nearly 90°, hinder angles broadly rounded, greatest width about one fourth more than length without ventrals. Mouth curved, width about two thirds of the distance from the end of the snout; teeth small, with sharp cusps obliquely directed inward, median sharper and more erect in males, in about 42 rows. Length of orbit one third of snout length, greater than interorbital width. Back smooth, except on the head, the anterior ends of the pectorals and the snout above and below. Snout rough with small spines above and below; top of head rough. Front upper ends of pectoral rough, with a large group of larger spines opposite the eyes; a group of several tubercles in front of each eye and another behind it; a large spine on the front end of the vertebral column; three series of tubercles on the tail, the median reaching the second dorsal; males with series of tenacula near the outer angles of the pectorals. Aside from the mentioned spines the body is smooth above and below. Claspers narrower and more pointed than those of *R. eglanteria*, Plate **23**.

Upper parts reddish brown with numerous more or less ocellate small

spots of brown. Bases of pectorals marked by a large yellow-edged blue-centered spot of black. Lighter yellowish along the anterior margins and at the sides of the rostral ridges. A dark spot below the end of the snout.

Specimen described a fully mature male from Nice. Total length 17, snout to abdominal pores 7.5, snout to mouth 2, and greatest width 10 inches.

Off coasts of southern Europe.

Raia maderensis.

Raia maderensis Lowe, 1841, Trans. Zool. soc. Lond., **2**, p. 195, 1843, Proc. Zool. soc. Lond., **11**, p. 94; Valenciennes, 1843, Ichth. Canar., p. 100, pl. 25; Duméril, 1865, Elasm., p. 545; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 459.

Rhomboid, broader than long, anterior angle little more than 90°, little more than outer angles, anterior margins nearly straight. Snout elongate, length about twice the interspiracular width, produced sharp. Distance between the nostrils, nearly equal their distance from the end of the snout. Teeth sharp, rows about 44 (39–44). Minute spines over entire body; small tubercules in front of and behind each orbit, one on each shoulder, and in a median series on back and tail, older examples with lateral rows more or less complete on the tail. Tail slender, longer than the body; produced behind the second dorsal. Dorsals separated by a space with tubercles. Total length 14.5, snout to pores 6.25, snout to mouth 1.875, and greatest width 9.5 inches.

Back brown with numerous rounded spots of lighter, larger behind the head above the abdomen.

Madeira and the Canaries.

Raia radiata.

Raia fullonica Fabricius 1780, Fauna Groenlandica, p. 125; Faber, 1829, Fische Islands, p. 38.
Raia radiata Donovan, 1807, Br. fish., **5**, pl. 114; Fleming, 1828, Brit. anim., p. 170; Jenyns, 1835, Man., p. 517; Yarrell, 1836, Brit. fishes, **2**, p. 439; Wright, Fries, Ekström, 1836, Skand. fish., p. 100, pl. 43; Parnell, 1838, Mem. Wern. soc., **7**, p. 439, pl. 43, f. 2; Fries, 1839, Vet. akad. Handl., p. 146, pl. 3, f. 4; McCoy, 1841, Ann. mag. nat. hist. **6**, p. 405; Müller & Henle, 1841, Plagios., p. 137; Kröyer, 1853, Danm. fiske, p. 938; Nilsson, 1855, Fisk. Skand., **4**, p. 736; Couch, 1865, Brit. fishes, **1**, p. 103, pl. 23; Duméril, 1865, Elasm., p. 531; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 460; Day, 1884, Brit. fishes, **2**, p. 347, pl. 73; Jensen, 1907, Dan. fiske, p. 326, pl. 30, f. 2.
Raia clavata Hollberg, 1822, Göth. vet. Handl., **4**, p. 29.
Amblyraya radiata Malm, 1877, Göteb. och Bohus. fauna, p. 607.

Shape of disk similar to that of *R. scabrata*, Plate **21**, perhaps a little more rounded. Snout angle obtuse, length in front of mouth about one and one half times the width of the internarial space. Teeth small, sharp, in 41–45 series

above or below. Scales stellate-based, closely set over disk and tail, especially so on the head. Large broad-based bucklers in a vertebral series, a pair on each shoulder, one in front of and one behind each eye and one behind each spiracle. A pair of similar stellate bucklers on each shoulder, others in a group above the snout, smaller ones opposite each eye on the pectoral, and others in one or two rows parallel with the vertebral. Males with a band of hooked tenacula near the outer angle of the pectorals.

Rusty brown with or without small round spots of dark, and without or with symmetrically placed small spots of light. The specimens described were sent from Norway by Professor Esmark. The measurements of one were in total length $13\frac{1}{4}$, snout to pores $6\frac{3}{4}$, and in width 9 inches; of another the total length was $12\frac{1}{2}$, the distance from the snout to the pores $6\frac{1}{4}$, and the greatest width $8\frac{1}{2}$ inches.

This species appears to be of smaller size and to be much rougher than the American form which has heretofore been identified with it. A specimen described by Yarrell, 1836, was a fully developed male at 19 inches in length.

Northern Europe to Iceland and probably Greenland.

Raia clavata.

Raia proprie dicta Belon, 1553, Aquat., p. 79.

Raia clavata Rondelet, 1554, Hist. poiss., p. 353, 354; Salviani, 1554, Aquat., f. 149; Gesner, 1558, Aquat., p. 936, 937; Aldrovandi, 1613, Pisc. & Cet., p. 460; Willughby, 1686, Pisc., p. 74, 78, pl. D 2, f. 3, 4; Artedi, 1738, Ichthyologia, p. 103, no. 1, Syn. p. 99, Gen., p. 71, no. 2; Gronow, 1754, Mus., **1**, p. 63, no. 140; 1763, Zoophy., **1**, p. 36, no. 154.

Raia clavata Linné, 1758, Syst., **1**, p. 232; 1766, Syst., **1**, p. 397; Valmont, 1768, Dict. d'hist. nat., **3**, p. 704; Duhamel, 1782, Traité, **4**, sect. 9, p. 279, pl. 9, f. 1–2; Bloch, 1785, Ausl. fische, **1**, p. 65, pl. 83; Bonnaterre, 1788, Ichth., p. 4, f. 9; Gmelin, 1789, Linné Syst., **1**, p. 1510; Walbaum, 1792, Artedi, p. 526; Lacépède, 1798, Poissons, **1**, p. 128; Schneider, 1801, Bloch Ichth., p. 366; Donovan, 1803, Br. fish., **2**, pl. 26; Risso, 1810, Ichth. Nice, p. 11; Montagu, 1815, Mem. Wern. soc., **2**, p. 416; Risso, 1826, Hist. nat., **3**, Poissons, p. 146; Jenyns, 1835, Man. p. 516; Wright, Fries & Ekström, 1836, Skand. fisk., p. 154, pl. 35; Parnell, 1838, Mem. Wern. soc., **7**, p. 436, pl. 42; Fries, 1839, Vet. akad. Handl., p. 15, pl. 2, f. 1, pl. 3, f. 1–3, 7; Müller & Henle, 1841, Plagios., p. 135; Kröyer, 1853, Danm. fiske, **3**, p. 962; Gray, 1854, Gron. syst., p. 9; Nilsson, 1855, Fisk. Skand., **4**, p. 735; Kessler, 1859, Bull. Soc. nat. Mosc., **2**, p. 475; Duméril, 1865, Elasm., p. 528; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 456; Moreau, 1881, Poiss. France, **1**, p. 391; Day, 1884, Brit. fishes, **2**, p. 343, pl. 171.

The thornback Brookes, 1763, Nat. hist., **3**, p. 39; Pennant, 1769, Zool., **3**, p. 69; Yarrell, 1836, Brit. fishes, **2**, p. 436.

Raia ruber Bloch, 1785, Ausl. fische, **1**, p. 67, pl. 84; Lacépède, 1789, Poissons, **1**, p. 107.

Dasybatus clavata Walbaum, 1793, Index Kleinii, p. 35; Blainv., 1830, Poiss. Fr., p. 33, pl. 5, f. 2; Bonaparte, 1841, Icon. Fauna Ital., Pesci.

Raia cuvieria Lacépède, 1798, Poissons, **1**, p. 141, pl. 7, f. 1; Schneider, 1801, Bloch Ichth., p. 367; Neill, 1811, Mem. Wern. soc., **1**, p. 554; Fleming, 1828, Brit. anim., p. 172.

Raia aspera Risso, 1810, Ichth. Nice, p. 5; 1826, Hist. nat., **3**, Poissons, p. 147.

Raia punctata Hollberg, 1822, Göth. vet. Handl., **4**, p. 25.

Dasybatus rubus Blainville, 1830, Poiss. Fr. p. 21, pl. 3c, f. 1.

Raia pontica Pallas, 1831, Zoog. Rosso-Asiat., **3**, p. 58; Rathke, 1837, Mem. sav. etrang. St. Peterb., **3**, p. 309, pl. 9, 10.

Disk shaped like that of *R. eglanteria*, Plate 23, length of body about two thirds of the width, front angle near 115°, lateral angles nearly 90° and narrowly rounded; anterior margins slightly sinuous; hinder angles rounded. Mouth waved, width two thirds of the distance from the end of the snout; teeth flattened, rounded, median more conical in males, in about 44 rows. Upper and lower surfaces rough with small scales, larger on the head and on the middle of the body. A vertebral series of large rounded bony bucklers with sharp compressed cusps from the head to the second dorsal; two lateral rows of bucklers at each side of the tail, a large buckler on the outer end of each shoulder, one in front of each eye, one or two behind each spiracle, one behind another on the end of the rostral cartilage, a large one opposite each eye near the margin and others scattered over the upper and the lower surfaces of the body gill chamber and bases of the pectorals. Young are less rough and have fewer bucklers; very young are nearly smooth. Males at hand are more smooth than females and lack many of the tubercles. Total length 30.25, snout to ends of pectorals 15, snout to abnominal pores 14.75, and greatest width 21.5 inches.

Brown to reddish brown, with or without numerous spots of brown and with irregular dark-edged spots of white.

Norway to Madeira; Mediterranean.

Raia ingolfiana.

Raia ingolfiana Lütken, 1898, Danish Ingolf exped., **2**, p. 3, pl. 1, f. 1.

Compared with *Raia hyperborea* the disk of this species is not so angular, the anterior margins are straighter, and the tail is longer and more robust. Disk nearly one fourth broader than long, front angle less than 90°, snout not produced, anterior margins slightly undulated, outer and hinder angles and hinder margins broadly rounded. Mouth moderate, little arched, width nearly half the distance from the end of the snout. Teeth small, pointed. Eyes medium, orbits two thirds of the interorbital width, or one fourth of the length in front of them. Spiracles smaller than the eyes. Tail little longer than the body, not produced behind the dorsals. Dorsals not separated by a space with spines. Back and head with scattered spinules, more abundant along the anterior margins, larger above the middle of the rostral cartilage. A pair of tubercles in front of and one or more behind each eye, a triangular group of three on each shoulder, a lateral series on each side of the tail, and a close-set median series of larger ones (47) from the head to the dorsal fin. Lower parts smooth.

Back brown; lower surface white, excepting some dark spots below the tail and the ventral fins.

Off Holstensborg, in Lat. 66° 35′ N., Long. 56° 38′ W. at a depth of 318 fathoms.

Raia fullonica.

Raia fullonica Rondelet, 1554, Pisc., p. 356; Gesner, 1558, Aquat., p. 938; Aldrovandi, 1613, Pisc., p. 462; Jonst., 1649, Pisc., 37, pl. xi, f. 4.
Raia aspera Willughby, 1686, Pisc., p. 78; Fleming, 1828, Brit. anim., p. 172.
Raia aspera nostras Ray, 1713, Pisc., p. 26.
Raia toto dorso aculeata Artedi, 1738, Ichthyologia, Syn., p. 101, Gen., p. 72, no. 6.
Raia fullonica Linné, 1758, Syst., **1**, p. 231; 1766, Syst., **1**, p. 396; Bonnaterre, 1788, Ichth., p. 3; Gmelin, 1789, Linné Syst., **1**, p. 1507; Walbaum, 1792, Artedi, p. 528; Schneider, 1801, Bloch Ichth., p. 367; Risso, 1810, Ichth., Nice, p. 6; Fries, 1838, Vet. akad. Handl., p. 150, pl. 2, f. 2; Müller & Henle, 1841, Plagios., p. 145; Kröyer, 1853, Danm. fiske, **3**, p. 296; Nilsson, 1855, Fisk. Skand., **4**, p. 737; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 467; Winther, 1879, Nat. tidskr., **12**, p. 61; Day, 1884, Brit. fishes, **2**, p. 342, pl. 170; Vaillant, 1888, Travailleur et Talisman, Poissons, p. 79, pl. 4, f. 1; Collett, 1905, Vid. selsk. Forh., no. 7, p. 140; Jensen, 1907, Dan. fiske, p. 336.
Raia spinosa Valmont, 1768, Dict. d'hist. nat., **3**, p. 704.
Rough ray Pennant, 1769, Zool., **3**, p. 66.
Shagreen ray Pennant, 1776, Zool., **3**, p. 77; Couch, 1865, Brit. fishes, **1**, p. 117, pl. 28.
Raia tuberculata Bonnaterre, 1788, Ichth., p. 3, no. 6.
Raia granulosa Schneider, 1801, Bloch Ichth., p. 368.
La raie chardon Ascanius, 1805, Icon., **5**, p. 4, pl. 43.
Raia chagrinea Montagu, 1815, Mem. Wern. soc., **2**, p. 420, pl. 21; Jenyns, 1835, Man., p. 513; Parnell, 1838, Mem. Wern. soc., **7**, p. 431, pl. 41; Parnell, 1840, Trans. Roy. soc. Edinb., **14**, p. 144; Duméril, 1865, Elasm., p. 560; Moreau, 1881, Poiss. France, **1**, p. 40.
Raia flossada Risso, 1826, Hist. nat., **3**, Poissons, p. 145.
Leucoraja fullonica Malm, 1877, Göteb. och Bohus fauna, p. 609.

Disk rhomboid, without the ventrals broader than long, acute angled in front, outer angles about 90°, anterior margins undulated, indented, hinder margins broadly rounded. Snout nearly one fourth of the width of the disk, three times the interorbital width, produced sharp. Teeth sharp, slender, in about 60 rows. Young and females covered with minute close-set spines. On males there are large naked spaces; tenacula are present on adults of this sex. A few tubercles above the end of the rostral cartilage, a series on each orbital ridge, a short median row behind the head on the shoulder girdle, with scattered tubercles farther back, two rows of larger tubercles on the top of the tail, which is without a median series, but has an irregular row at each side on large individuals. Tail shorter than disk.

Specimens are taken of a total length of more than three feet.

Yellowish to reddish brown.

Off coasts of Europe to Madeira.

Raia lintea.

Raia lintea Fries, 1838, Vet. akad. Handl., p. 154; Müller & Henle, 1841, Plagios., p. 147; Kröyer, 1853, Danm. fiske, **3**, p. 1005; Nilsson, 1855, Fisk. Skand., p. 738; Malm, 1857, Öfvers. Vet. akad. Förh., p. 193; Duméril, 1865, Elasm., p. 557 (part); Günth., 1870, Cat. fishes Brit. mus., **8**, p. 466; Collett, 1905, Forh. vid. selsk. Chr., no. 7, p. 122.
Leucoraia lintea Malm, 1877, Göteb. och Bohus. fauna, p. 611.

Disk rhomboid, length without ventrals somewhat less, and length with ventrals little more than the greatest width, portion in front of the shoulder girdle longer than that behind it, front angle acute, outer angles little more than 90°, rounded, anterior margins not waved, little indented, posterior margins shorter, irregularly curved. Snout long, more than twice the width of the mouth. Mouth medium, somewhat curved. Teeth small, sharp, unequal, in about 50 rows.

Excepting some stellate hooked spines along the anterior margins and the tubercles, the back is almost smooth. A median series of ribbed tubercles on back and tail more or less broken above the body, a lateral series at each side of the tail a single tubercle in front and two or three behind each orbit, three on each shoulder, and some smaller ones above the snout on the rostral cartilage. Tail depressed, hardly half of the total length. Dorsals close together.

Uniform greyish brown; lower surface lighter, with blackish pores.

Northern Europe.

Raia bathyphila.

Raia bathyphila Holt & Byrne, 1908, Sci. inv. fisheries Ireland, **5**, p. 51.

Allied to *Raia isotrachys* Günth. Anterior margins slightly undulated, angle about 85.5°. End of snout rounded; outer angles broadly rounded, nearer to the hinder end of the disk. Teeth small, blunt, in about 36 rows on the upper jaw. Back with small slender spinules, each with about four radiating basal processes. Orbital ridges with a small tubercle in front and two behind each eye. Three tubercles on the median line from the head to the shoulder girdle, two others at each end of the girdle. Thirty tubercles on the median line from the shoulder girdle to the dorsal fin, some of them larger than others and with bases more swollen. Total length 184 mm., length of disk 88, length of snout 29, length of tail from bases of ventrals 98, and width of disk 101 mm.

Ashy brown to blackish; lower surface brown, except front of snout, mouth parts and belly.

Northwest of the Hebrides, in Lat. 51° 12′ 30″ N., and Long. 12° 18′ W., from a depth between 893 and 673 fathoms.

Raia borea.

Raia hyperborea Günther, 1887, Challenger rept. Zool., **22**, p. 8, pl. 4.
Raia borea Garman, 1899, Mem. M. C. Z., **24**, p. 24.

Disk broader than long, front angle more than 90°, anterior margins undulated but not indented, hind margins slightly convex, hind angles broadly rounded, outer angles nearly 90°, rounded. Snout very blunt, length little more than the interorbital width, about equal to the distance between the spiracles. Mouth arched, width nearly equal to the distance from the end of the snout; teeth small, sharp, slender, with narrow bases, widely set.

Tail shorter than the body, with wide lateral folds, dorsals close together, with or without a spine between them. Back roughened by small stellate-based spines, larger on the rostral ridges and along the front margins. A median series of small tubercles from the head to the dorsals, a row of three or four above each eye and spiracle, and a group of three on each shoulder. Sides of trunk nearly smooth.

Greyish brown with a trace of a darker spot on each side of the body; white below, uniform on very young, with subsymmetrical blotches of brown on the older.

Type, a male of 24½ inches, taken in the Faroe Channel at a depth of 608 fathoms.

The reasons for separating this species from *R. hyperborea* will be seen at a glance on comparing the figures of the two as published by Collett and Günther. The type of *R. hyperborea* has a long snout like that of *R. batis*, or that shown, fig. 2, Plate **22**; *R. borea* was figured from a specimen four and a half inches longer, yet it has the shorter snout and its outlines are more like those of fig. 1, Plate **22**. Slight differences appear in the squamation. The coloration in both is that of the Raiae of the deep sea.

Raia hyperborea.

Raia hyperborea Collett, 1878, Forh. vid. selsk., Chra., no. 14, p. 7; 1880, Norweg. N. Atl. exped., p. 9, pl. 1, f. 1, 2; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 28, pl. 9, f. 28; Garman, 1899, Mem. M. C. Z., **24**, p. 24.

Disk broader than long, front angle acute, anterior margins undulated, indented, outer angles nearly 90°, hardly rounded, hind margins almost straight, slightly convex. Snout sharp, length about one and one half times the width of the mouth, or about twice the interorbital width. Mouth arched; teeth

sharp (male), slender, in $\frac{36}{42}$ rows. Tail about one third of the total length. Dorsals separated by a narrow space with a spine. Back roughened by minute spines and tubercles; a striate-based tubercle in front of and one behind each eye, one behind each spiracle, two — one behind the other — on each shoulder, and a nearly complete median series (of 27) from the head to the second dorsal. Lower surfaces smooth.

Upper parts uniform dark greyish brown; lower white with large blotches of brown, nearly alike on the two sides.

Type, a male of 20 inches in length, taken off the north coasts of Spitzbergen, in 80° N. Lat., at a depth of 459 fathoms.

Raia batis.

Raia undulata sive *cinerea* Rondelet, 1554, Pisc., p. 346.
Raia varia Artedi, 1738, Ichthyologia, Syn., p. 102, Gen. p. 73, no. 9.
Raia batis Linné, 1758, Syst., **1**, p. 231; 1766, Syst., **1**, p. 395; Bloch, 1784, Fische Deutschl., **3**, p. 54, pl. 79; Bonnaterre, 1788, Ichth., p. 2, pl. 2, f. 6; Gmelin, 1789, Linné Syst., **1**, p. 1505; Walbaum, 1792, Artedi, p. 531; Schneider, 1801, Bloch Ichth., p. 369; Risso, 1810, Ichth. Nice, p. 3; Hollberg, 1822, Göth. vet. Handl., p. 21; Fleming, 1828, Brit. anim., p. 171; Faber, 1829, Fische Islands, p. 33; Jenyns, 1835, Man., p. 510; Fries, 1838, Vet. akad. Handl., p. 158, pl. 3, f. 6; Müller & Henle, 1841, Plagios., p. 146; Kröyer, 1853, Danm. fiske, **3**, p. 978; Nilsson, 1855, Fisk. Skand., **4**, p. 739; Malm, 1857, Öfvers. Vet. akad. Förhl., **1**, p. 193; Duméril, 1865, Elasm., p. 563; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 463; Moreau, 1881, Poiss. France, **1**, p. 409; Day, 1884, Brit. fishes, **2**, p. 336, pl. 166; Holt & Calderwood, 1895, Trans. Roy. Dublin soc., new ser., **5**, p. 385.
Raia undulata Valmont, 1768, Dict. d'hist. nat., **3**, p. 706.
Skate Pennant, 1769, Zool., **3**, p. 62; Yarrell, 1836, Brit. fishes, **2**, p. 421.
Raia laevis, alba Duhamel, 1782, Traité, **4**, p. 284, pl. 11.
Dipturus batis Rafinesque, 1810, Caratteri, p. 16; Indice, p. 48.
Raia gaimardi, Val., 1847, Gaim. voy. Isl. & Groenl. poiss., pl. 2, 3; Duméril, 1865, Elasm., p. 565.
Raia leiobatos Gray, 1854, Gron. syst., p. 10.
Laeviraia batis Malm, 1877, Göteb. och Bohus. fauna, p. 615.

Shape similar to that of *R. stabuliforis*, Plate **22**, fig. 2; disk hardly broader than long, anterior angle nearly 90°; snout produced, blunted at the end; anterior margins slightly waved, little concave; outer angles blunted, hinder broadly rounded. Mouth wide, nearly straight, width almost equal to half its distance from the end of the snout; teeth small, crowns depressed with a sharp cusp directed inward, in about 56 rows in a specimen of thirty inches in length. Parts of the back and the top of the tail are roughened with small spines; young with a spine in front of and one behind each eye. Tail nearly half of the total length, with strong lateral folds, with a median series of small compressed tubercles and, in the female, with another series along each lateral fold. Dorsal fins separated by a space with a spine. Total length of specimen, from Triest,

30, snout to pores 15.5, snout to ends of pectorals 16, and greatest width 15.5 inches.

Dark brownish, uniform, clouded, or spotted with small spots of white and of dark; lower surfaces brownish, ends of tubes dark.

This species and *R. stabuliforis* are separated by the dentition; in most other respects they are much alike.

Off the coasts of Europe.

Raia alba.

Sharp nosed ray Pennant, 1769, Zool., **3**, p. 64; Low, 1813, Fauna Orcad., p. 168.
Raia laevis major Duhamel, 1782, Traite, **4**, p. 285, pl. 11, f. 3, 4.
Raia alba Lacépède, 1803, Poissons, **5**, p. 661, pl. 20, f. 1; Blainv., 1830, Poiss. Fr., p. 14; Moreau. 1881, Poiss. France, **1**, p. 412; Day, 1884, Brit. fishes, **2**, p. 339, pl. 168.
Raia marginata Lacépède, 1803, Poissons, **2**, p. 663, pl. 20, f. 2; Risso, 1826, Hist. nat., **3**, Poissons, p. 148; Blainv., 1830, Poiss. Fr., p. 19, pl. 3, f. 2; Jenyns, 1835, Man., p. 512; Bonaparte, 1841, Icon. Fauna Ital., Pesci, p. 471, pl. 61; Müller & Henle, 1841, Plagios., p. 140; Duméril, 1865, Elasm., p. 568; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 465.
Raia oxyrynchus Turton, 1806, System., **1**, p. 926; Montagu, 1815, Mem. Wern. soc., **2**, p. 423; Fleming, 1828, Brit. anim., p. 171; Jenyns, 1835, Man., p. 511; Thompson, 1856, Nat. hist. Ireland, **4**, p. 259.
Raia rostellata Risso, 1810, Ichth. Nice, p. 8, pl. 1, 2.
Raia bicolor Risso, 1826, Hist. nat., **3**, Poissons, p. 155.
The bordered ray Yarrell, 1836, Brit. fishes, **2**, p. 426; Couch, 1867, Brit. fishes, **1**, p. 110, pl. 26.
Laeviraia bramante Sassi, 1846, Nouv. ann. Soc. nat. Bologna, **6**, p. 386; Canestrini, 1864, Mem. Real accad. sci. Torino, ser. 2, **21**, pl. 1, f. 2–5; Doderlein, 1884, Man. ittiol. Medit., **3**, p. 164.
Raia lintea Kröyer, 1853, Danm. fiske, **3**, p. 1005.
Burton skate Couch, 1867, Brit. fishes, **1**, p. 97, pl. 21 (excl. syn.).

Disk rhomboid, length of body less than two thirds of its width, anterior margins deeply undulated, outer angles nearly 90°, hinder margins broadly rounded backward almost straight or slightly concave near the outer angles. Snout long, narrow, acuminate, length twice the width of the mouth or more. Mouth large, moderately curved; teeth small, in 46 (40–46) rows, cusps sharp, keel-like. Tail half or less than half of the total length, much depressed, retaining width backward, pointed behind the dorsals. Dorsals separated by a space with a tubercle. Tubercles compressed, hooked: one in front and one behind each orbit, a median and two lateral series on the tail extending to the second dorsal. Back smooth; lower surface rough with small slender spines below the snout and the anterior edges of the pectorals. Males with tenacula.

Back light reddish brown, more or less spotted with white, darker toward the outer margins; translucent spaces at sides of rostral cartilage white; lower parts brownish white to white anteriorly, and brown below the outer portions of pectorals and ventrals; tail dark below, blackish above, brownish at the sides.

Specimen described a young male from Nice: total length 12, snout to

abdominal pores 5.75, snout to mouth 2.125, and greatest width 8.75 inches. Said to reach a length of seven feet or more.

Off coasts of Europe.

Raia acus.

The sharp-nosed ray Pennant, 1769, Zool., **3**, p. 64; Yarrell, 1836, Brit. fishes, **2**, p. 424.
Raia acus Lacépède, 1803, Poissons, **5**, p. 662.
Raia oxyrinchus Montagu, 1815, Mem. Wern. soc., **2**, p. 423; Jenyns, 1835, Man., p. 511; Day, 1884, Brit. fishes, **2**, pl. 169.
Raia vomer Fries, 1838, Vet. akad. Handl., p. 161; Müller & Henle, 1841, Plagios., p. 144; Kröyer, 1853, Danm. fiske, **3**, p. 1011; Malm, 1857, Öfvers. Vet. akad. Förhl., p. 193; Duméril, 1865, Elasm., p. 571; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 468.
Long-nosed skate Couch, 1867, Brit. fishes, **1**, p. 93, pl. 19.

Similar in shape to *R. oxyrhynchus*, but differing somewhat in armature and coloration. Length of disk including the ventrals about equal to the width, anterior margins much indented, snout very long, nearly six times the interorbital space, pointed; outer angles rather less than 90°, blunted at the apices, posterior angles little larger. Mouth curved; teeth in about 46 rows, in a specimen four feet in length, each tooth with a sharp prominent keel, sharper in the male. Ventrals deeply notched. Tail strong, depressed, shorter than the disk. Disk rough with minute scales; tail with a series of sharp compressed tubercles along each side, individuals also acquiring with age scattered tubercles or a series on the median line. Very young smooth. Reaches a length of six feet or more.

Back brown, with scattered small spots of lighter or of darker or of both, becoming more uniform with age.

Though apparently reaching a much greater size, this species is so closely allied to *R. oxyrhynchus* that it is difficult to separate them in many cases.

Northern Europe.

Raia macrorhynchus.

Raia ὀξύρυγχος Rondelet, 1554, Pisc., 347; 1558, Hist. poiss., p. 274.
Raia macrorynchus Rafinesque, 1810, Caratteri, p. 15; Indice, p. 47; Duméril, 1865, Elasm., p. 566; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 468; Moreau, 1881, Poiss. France, **1**, p. 405; Doderlein, 1881, Man. ittiol. Medit., **3**, p. 156; Day, 1884, Brit. fishes, **2**, p. 338, pl. 167.
Raia mucosissima Nardo, 1827, Prod. Adriat. Ichthy., p. 8.
The flapper skate Parnell, 1838, Mem. Wern. soc., **7**, p. 249; Yarrell, 1839, Brit. fishes, Suppl., p. 66.
Raia intermedia Parnell, 1838, Mem. Wern. soc., **7**, p. 429, pl. 40; Yarrell, 1839, Brit. fishes Suppl., p. 66, fig.; McCoy, 1841, Ann. mag. nat. hist., **6**, p. 405; White, 1851, Cat., p. 139; Kröyer, 1853, Danm. fiske, **3**, p. 1015.
Laeviraia macrorhynchus Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 63, f. 2.

Disk rhomboid, wider than long, front angle acute, outer angles nearly 90°, anterior margins deeply concave, hinder broadly rounded. Snout about six

times as long as the eye. Mouth moderate, slightly arched. Teeth with a pointed keel in males, blunter in females, in about 50 rows. Young smooth; adults with scattered minute asperities. A median series of small tubercles on the tail, in most cases a less complete lateral series at each side, and in many cases a small tubercle, or more than one, in front of each orbit. Tail medium, nearly half of the total length, produced behind the second dorsal. Dorsals separated by a space with spines.

Back brown, uniform or clouded, to spotted with white; lower surface dingy white, with blackish pores.

British Islands to the Mediterranean.

Raia oxyrhinchus.

Alia Raia ὀξύρυγχος Rondelet, 1554, Pisc., p. 348; Gesner, 1558, Aquat., p. 933; Willughby, 1686, Pisc., p. 71.
Laeviraia sp. Salviani, 1554, Aquat., f. 149, pl. 52; Willughby, 1686, Pisc., p. 71, pl. C 4.
Raia varia Artedi, 1738, Ichthyologia, Syn., p. 101, Gen., p. 72, no. 8.
Raia oxyrinchus Linné, 1758, Syst., **1**, p. 231; 1766, Syst., **1**, p. 395; Brunnich, 1768, Ichthy. Massiliensis, p. 2; Blainv., 1830, Poiss. Fr., p. 18, pl. 3, f. 1; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 469; Holt & Calderwood, 1895, Trans. Roy. Dublin soc., new ser., **5**, p. 386.
Raia laevis Valmont, 1768, Dict. d'hist. nat., **3**, p. 705.
Raia rostrata Risso, 1810, Ichth. Nice, p. 7; 1826, Hist. nat., **3**, Poissons, p. 156.
Raia morula Nardo, 1827, Prod. Adriat. Ichthy., p. 8, 17; Isis, p. 476–483.
Raia salviani Müller & Henle, 1841, Plagios., p. 143; Duméril, 1865, Elasm., p. 569.
Laeviraia oxyrhinchus Bonaparte, 1841, Icon. Fauna Ital., Pesci.
Raia nidrosiensis Collett, 1881, Forh. vid. selsk. Chra., no. 7, pl.; 1904, Forh. vid. selsk. Chra., no. 9, p. 123.

Disk rhomboid, little wider than long, anterior borders deeply emarginate, snout long, depressed, sharp, in length three times the width of the mouth or the internarial space, outer angles blunted, hinder angles broadly rounded. Mouth slightly curved; teeth in about 40 rows, in specimens measuring three feet in length, median teeth larger, sharper. Spiracles not as large as the eyes. Ventrals deeply notched. Back roughened by small spines about the head, snout, forward edges of the disk and top of tail; on adult males a median row of small tubercles on the tail. Frequently lateral rows are seen on the sides of the tail, and scattered tubercles on the back and head appear in the young. Males smoother, with erectile tenacula near the outer angles of the pectorals. Ventral surfaces roughened in large individuals.

Brown with more or less definite spots of whitish or dark or both, to uniform; whitish below, openings of pores black. Old specimens uniform dark brown.

The specimens described, from Nice, have the following measurements:—

(1) Total length 35, snout to mouth 8.5, snout to abdominal pores 20 and greatest width 23 inches.

(2) Total length 27, snout to mouth 7, snout to pores 17, and greatest width 17 inches.

The northern variety, *R. nidrosiensis*, is darker in color and less spotted.

Europe; Mediterranean.

Raia maroccana.

Raia maroccana Schneider, 1801, Bloch Ichth., p. 367; Müller & Henle, 1841, Plagios., p. 150, pl. 49, f. 2; Duméril, 1865, Elasm., p. 559; Günth., 1870, Cat., fishes Brit. mus., **8**, p. 466.

Disk rhomboid, snout long, three and one half times the interorbital width, pointed, anterior margins undulated, little indented, outer angle about 90°, hinder margins and angles rounded. Teeth of adult male conical, pointed, in 41 series on the upper jaw. Skin naked, excepting a few minute spines on the middle of the back, on the margins of the disk and under the snout, on the head, also a group of larger ones on the forward ends of the pectorals, and the tubercles in a row on the orbital ridges and in two lateral rows and a median row, of alternating sizes, on the tail. Tail longer than the body moderately slender; dorsal fins separated by a space. Male with tenacula.

Total length of an adult male about 22, length of disk 11, and greatest width 13½ inches.

Light brownish, nearly uniform.

Morocco.

Eastern North American species.

Raia plutonia.

Plate **18**, fig. 1.

Raia plutonia Garman, 1881, Bull. M. C. Z., **8**, p. 236; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 878; Goode & Bean, 1883, Bull. M. C. Z., **10**, p. 225; Günther, 1887, Challenger rept. Zool., **22**, p. 10; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 69; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 27, pl. 8, f. 26.

Disk rounded, anterior margins slightly concave near the middle; snout, outer angles and hinder angles, and margins broadly rounded, tip of snout a blunt angle. Rostral cartilage short. Mouth little curved, width about half the distance from the end of the snout. Teeth in about 32 rows (juv.). Eyes large, orbits longer than their distance apart. Anterior nasal valves reaching the mouth, narrow, joined to a wide isthmus; posterior valves short, tubular. Ventral fins deeply notched, anterior portion narrow, longer than the posterior. Back and tail covered with small closely set hooked spines. The larger tubercles

with broad heart-shaped bases stand as follows: — a row on each orbital ridge, a single one at each side of the occiput, four on each shoulder, one in front of each four, and a median series from the back of the head to the dorsal accompanied by one lateral row from above the abdomen and by two lateral rows from the base of the tail. Lower surfaces smooth.

Back a warm brown with irregular transverse series of darker blotches interspersed with smaller spots of white. Tail with transverse blotches of darker; lower surface white.

Total length of specimen described 9.76, snout to pores 3.38, greatest width 4.5 inches.

Taken in Lat. 31° 57′ N.; Long. 78° 18′ 35″ W., in 333 fathoms, by the U. S. C. S. S. Blake.

Raia ornata.

Plate **18**, fig. 2.

Raia ornata Garman, 1881, Bull. M. C. Z., **8**, p. 235; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 877; Goode & Bean, 1883, Bull. M. C. Z., **10**, p. 225; 1896, Mem. M. C. Z., **22**, p. 26 (non pl. 8, f. 24); Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 70.

Disk to ends of pectorals little broader than long, very blunt angled in front, convex opposite the eyes, rounded on outer and hinder margins and angles. Mouth waved, width two thirds of the distance from end of snout. Teeth small, in 44 rows (juv.). Eyes large, distance apart about half that from end of snout. A vertebral series of tubercles on back and tail, one lateral series at each side of the median row on the back and two laterals at each side of it on the tail, a series on each orbital ridge, a spine on the forehead between the eyes, a group of several above the end of the rostral cartilage, a single spine on each shoulder, a group near each ventral on the pectoral and another on the same fin near its forward extremity include the larger spines, but in addition the entire upper surface is rough with very small ones. Lower surfaces smooth. The specimen described has a total length of 8, snout to pores $3\frac{1}{2}$, and greatest width 4 inches.

Light brownish freckled with lighter and marked with symmetrically placed rosettes or groups of darker spots, usually six around a central one.

Off the coasts of Florida, in about 140 fathoms; U. S. C. S. S. Blake.

Raia ackleyi.

Plate **19**.

Raia ackleyi Garman, 1881, Bull. M. C. Z., **8**, p. 234; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 25 (non pl. 7, f. 2); Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 70.

Disk without the ventrals broader than long, nearly right angled in front, outer and hinder angles and hinder margins rounded. Length of snout less than twice the interspiracular width, tip slightly blunted, rostral cartilage slender. Tail moderately slender, little longer than the body, hardly extended beyond the second dorsal. Mouth small, width more than half the distance from the end of the snout. Teeth small, sharp, in about 42 rows. Anterior nasal valve reaching the angles of the mouth, joined to a wide isthmus which is deeply concave between them. Ventral notch moderate, forward portion of fin rather small; dorsals separated by a space with tubercles. A median series of tubercles on back and tail, two lateral series on each side of the tail, a series on each orbital ridge, a group above the end of the rostral cartilage, a group on the anterior extremity of each pectoral opposite the eye and the spiracle, the shagreen below the snout and the tenacula on males include nearly all of the asperities; excepting these, the male described is about smooth. Females and young as in allied species are no doubt more rough. Total length $16\frac{1}{4}$, snout to abdominal pores $7\frac{1}{2}$, and greatest width 9 inches.

In the original description the length of the tail should have been 8.6 instead of 9.6 inches.

Light yellowish brown with small spots of brown intermixed with others of white. An oblong rounded spot of black behind each shoulder is surrounded by a series of the small spots of brown. Lower surfaces white.

Yucatan Banks, Gulf of Mexico. U. S. C. S. S. Blake.

Raia erinacea.

Plate **20**; Plate **55**, fig. 5 (vertebrae); Plate **68**, fig. 1 (skeleton).

Raia eglantiera Lesueur, 1824, Journ. Acad. nat. sci. Phil., **4**, 103, with plate (not *R. eglanteria* Lacépède, 1800).

Raia erinacea Mitch., 1825, Amer. journ. sci., **9**, p. 290, pl. 6; DeKay, 1842, N. Y. fish, 372, pl. 78, f. 246; Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 259; Garman, 1874, Proc. Bost. soc. nat. hist., **17**, p. 176, fig.; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 40; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 68, pl. 9, f. 29.

Raia eglanteria Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 259; Duméril, 1865, Elasm., 532; Günth, 1870, Cat. fishes Brit. mus., **8**, 462.

Anterior margins of disk waved, convex opposite the eyes, concave opposite the spiracles, outer and hinder angles and margins rounded. Snout short, longer than that of *R. diaphanes*, about one and one half times the interspiracular width. Mouth strongly waved; teeth in about 50 rows. Back rough, with strong hooked spines over almost the entire surface on females, especially rough near and on the head, on the snout, about the shoulders, on the hinder portions

of the pectorals and on the tail. A triangular patch of strong spines appears in front of the shoulder girdle, others are seen on each shoulder, and in one to several rows at each side of the median line on the back. The vertebral line is quite or nearly without tubercles; the tail has two to four rows at each side. Males have not so many tubercles as the females; their spines are more scattered, and smooth spaces exist on the middle of the back, over the gills and above the abdomen; they have the band of erectile tenacula near the outer angle of the pectoral. Total length $19\frac{1}{2}$, snout to abdominal pores $9\frac{3}{4}$, and greatest width $11\frac{1}{4}$ inches.

Back light greyish brown to very dark, clouded to nearly uniform, usually spotted with small spots of darker, margins sometimes light. Colors darker northward.

Described and figured from adult specimens of about $19\frac{1}{2}$ inches in length, taken by Mr. George Nelson at Quincy, Massachusetts.

Halifax to the Carolinas, abundant off New England and New York.

Raia senta.

Plate **25**, fig. 1.

Raia senta Garman, 1885, Proc. U. S. nat. mus., **8**, p. 43; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 508; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 70.

Disk resembling that of *Raia eglanteria*, Plate **23**, but differing in the sharp snout, the rounded outer angles, the slender pointed claspers, the separated dorsals and the squamation. Snout sharp, in length one and three fourths times the width of the mouth. Outer and hinder angles and margins broadly rounded, anterior margins undulated. Mouth large, much curved, symphysis of upper jaws deeply indented; teeth small in 38 rows, median larger and sharper. Interorbital space deeply concave, width two sevenths of the length of the snout from the eyes. Tail shorter than the disk, slender, moderately depressed, lateral folds beginning far back near the dorsals. Dorsals small, united by a membrane, with a rudimentary caudal behind the second. Claspers long, slightly depressed, strong in the basal half, more slender distally, pointed.

Back and top of tail rough with small spines; larger spines on the anterior parts of the pectorals, along the outer margins, in a row on the orbital ridges, a group on each shoulder and in a vertebral series from the back of the head to about the middle of the tail, where they dwindle and disappear. Male with a band of erectile tenacula near the outer angles.

Described and figured here from an adult male secured by Prof. Louis

Agassiz off the New England Coast. Total length $22\frac{1}{2}$, tail from axil of ventrals $11\frac{1}{2}$, disk to ends of pectorals $11\frac{1}{5}$, greatest width 14 inches.

Rusty brown, clouded with darker, apparently uniform. Originally described from an immature female, with a white spot on the middle of the back and another across the base of the tail. Other differences occur in the types but they are such as may be peculiar to the young.

Raia diaphanes.

Plate **22**, fig. 1.

Raia ocellata Mitch., 1815, N. Y. lit. & philos. trans., **1**, p. 477; Storer, 1839, Report fishes, p. 191; Duméril, 1865, Elasm., p. 539; Garman, 1874, Proc. Bost. soc. nat. hist., **17**, p. 177; 1888, Bull. M. C. Z., **6**, p. 91, pl. 30; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 40; Jord & Everm., 1896, Bull. 47, U. S. nat. mus., p. 68, pl. 10, f. 30 (non *R. ocellata* Russell, 1803).

Raia diaphanes Mitch., 1815, N. Y. lit. & philos. trans., **1**, p. 478; DeKay, 1842, N. Y. fish., p. 366, pl. 67, f. 218; Storer, 1867, Mass. fishes, p. 264, pl. 39, f. 1.

Raia batis Wyman, 1864, Mem. Amer. acad., new ser., **9**, p. 34; Ann. mag. nat. hist., ser. 3, **14**, p. 399.

Anterior margins of disk waved, prominently convex opposite the eyes, concave near the middle, outer and hinder angles and margins rounded. Snout short, blunt, little longer than the interspiracular width. Mouth waved; teeth in about 90 rows (80 to 110). Back rough with sharp spines on the head, around the eyes, along the anterior margins and on the front ends of the pectorals, and in places about the shoulder girdle near the hind margins of the pectorals and above the ventrals. Tail rough. The tubercles are absent from the median line of the tail and to some extent from the middle of the back; a lateral series begins above the abdomen on each side, and is continued on the tail with one or more additional rows. Males with a band of erectile tenacula near the outer angles of the disk; claspers elongate, more slender and narrow backward. Dorsal fins near the end of the tail usually not separated by tubercles. Females are more spinose than males.

Brown with small spots of darker and with or without ocellate spots of white on the pectorals opposite the abdomen; below white.

One of the most common species off the eastern United States.

Distinguished from its nearest ally, the small species *R. erinacea*, by the dentition and by colors.

Raia scabrata, sp. nov.

Plate **21**; Plate **44**, fig. 1–3.

Raia radiata Storer, 1839, Report fishes, p. 201; Gill, 1861, Proc. Acad. nat. sci. Phil., p. 61 extra; Garman, 1874, Proc. Bost. soc. nat. hist., **17**, p. 178; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 41; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 25, pl. 9, f. 27 juv.; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 69.
Raia laevis Storer, 1867, Mass. fishes, p. 266, pl. 39, f. 2.

Closely allied to *R. radiata* but larger, less rough, and rather more angular. The small scales are sparsely scattered or absent from considerable areas; both scales and tubercles are stellate-based. Large tubercles occur in the median dorsal series, in a pair on each shoulder, hinder larger, as a single tubercle in front of and one behind each eye and one behind each spiracle, and in three rows of smaller ones above the snout. A row of much smaller tubercles at each side of the median extends from the shoulder girdle backward and is more or less doubled or irregular on the tail. A few small scales above the ventrals. On the pectorals the bucklers are large near the bases of the fins and decrease in size toward the margins near which they disappear. Most often the second dorsal is separated from the first by a space with a tubercle. Males of 26 inches in length are nearly mature; they have two rows of erectile tenacula near the outer angles on the pectoral fins.

Comparative smoothness of the skin between the tubercles, greater size, and slight differences in dentition distinguishes this form from the European *R. radiata*. The difference in regard to squamation appears to be quite as marked on the young as on adults.

Back brown, somewhat clouded, spotted with darker brown on young; lower surfaces white. Specimen No. 254, M. C. Z., 23 inches in length is milk-white with a few spots of reddish brown on the middle of the back, with a brown spot larger than the eye across each dorsal, and with three blotches of brown across the base of the tail. Rarely a specimen is blotched with brown on the ventral surface.

Specimens described from Massachusetts Bay. Total length $31\frac{1}{8}$, from snout to abdominal pores 16, and greatest width 23 inches; younger individual, length $14\frac{1}{8}$, greatest width $8\frac{1}{4}$ inches.

Raia eglanteria.

Plate **23**.

Raia eglanteria Lacépède, 1800, Poissons, **2**, p. 109, pl. 4, f. 2; Garman, 1874, Proc. Bost. soc. nat. hist., **17**, p. 179; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 41; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 71.

Raia desmarestia Lesueur, 1824, Journ. Acad. nat. sci. Phil., **4**, p. 100, pl. 4; Müller & Henle, 1841, Plagios, p. 154; DeKay, 1842, N. Y. fish., p. 372; Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 259; Duméril, 1865, Elasm., p. 551.

Raia chantenay Lesueur, 1824, Journ. Acad. nat. sci. Phil., **4**, p. 106, pl. 5; Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 260.

Raia americana DeKay, 1842, N. Y. fish., p. 368, pl. 66, f. 215.

Raia ocellata DeKay, 1842, N. Y. fish., p. 369, pl. 65, f. 212.

Disk much broader than long, anterior angle little more than 90°, margins concave opposite the spiracles, outer angles blunted, hinder broadly rounded. Snout blunted at the end, elongate, nearly twice the distance between the spiracles, or one and one half times the width of the mouth. Mouth wide, waved; teeth sharp, in $\frac{46}{42}$ rows. Disk and tail rough above, rougher on young and females. Sharp spines on the rostral ridges, larger in a group opposite the eyes, on the ridges, on the median line of the back and tail, in two or more lateral rows on the tail and in a pair on each shoulder. Smooth areas occur over the gills and abdomen, and many of the smaller spines appear to be lost by adults. Males have the bands of tenacula near the outer angles of the disk, the number of hooks increasing with age. The claspers of the male are even more depressed and broadened posteriorly than those of *R. scabrata*.

Specimen figured and described from Charleston, S. C., received through the Smithsonian Institution. Total length 21, snout to pores $10\frac{1}{2}$, greatest width $13\frac{1}{2}$ inches.

Cape Cod to Florida, abundant off New York and the Carolinas.

Raia stabuliforis, sp. nov.

Plate **22**, fig. 2; Plate **44**, fig. 4–6 (brain).

Raia laevis Mitch., 1818, Amer. mo. mag., **2**, p. 327; DeKay, 1842, N. Y. fish., p. 370; Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 259; Garman, 1874, Proc. Bost. soc. nat. hist., **17**, p. 180; 1888, Bull. M. C. Z., **22**, p. 90, pl. 27–29; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 42; Goode & Bean, 1896, Mem. M. C. Z., **22**, p. 28, pl. 9, f. 29; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 71.

Raia batis Storer, 1839, Report fishes, p. 193.

Disk broader than long, snout produced, anterior margins sinuous, concave; outer angles slightly, and posterior angles broadly rounded; head and base of rostral cartilage rather broad, crown concave transversely. Eyes small, orbits

nearly one fifth of their distance from the end of the snout. Spiracles as large as the eyes. Mouth large, width more than half the length of the snout. Teeth flat in females, sharper in males, in $\frac{32-35}{32-34}$ rows. Upper surface smoother than on most skates; a narrow belt of small spines extends along the anterior margins, areas of larger ones appear on the top of the snout, between and in front of the eyes and between and behind the spiracles, and scattered small spines occur here and there over shoulders and back. A more or less complete series of small tubercles with sharp compressed cusps stands above the vertebrae from the hinder part of the back to the dorsals, one or two usually appearing between the latter fins. At each side of the tail immediately above the lateral fold there is a series of tubercles extending to a point opposite the second dorsal. Very small spines occur between the rows on the tail and forward. Those on the end of the snout are directed up and forward. Males have several to five or six rows of tenacula in the band near the outer angles of the pectorals, and the ventral claspers are comparatively slender and pointed, more like those of *R. diaphanes* and *R. erinacea* than those of *R. eglanteria* or *R. scabrata.*

Brownish to reddish brown, with small scattered unequal spots of dark, smaller than the eye to very small. Lower surface lighter to white, darker forward, profusely dotted with black in the openings of the tubes. The black specks form series of seven or more at each side of the middle of the forward part of the abdomen and of about twenty at the forward edge of each outer extremity of the pelvis.

The "Barndoor" skate is very common off the New England Coast; it attains a length of six feet or more. The species is a close ally of *R. batis* of Europe but is readily distinguished by the small number and larger size of the teeth. This is the *Raia laevis* of Mitchill, 1817, but is not *R. laevis* of Gronow, 1763, of Valmont, 1765, and of Duhamel, 1782.

A male from Cohasset, Mass., Dr. H. B. Bigelow, measures in total length 58, tail from vent 27, and greatest width of disk 42 inches; the portion of the clasper free from the ventral fin measured $12\frac{1}{2}$ inches; the teeth were in $\frac{35}{34}$ rows.

Raia granulata.

Raia granulata (Gill) Goode and Bean, 1879, Bull. Essex inst., **11**, p. 28; 1896, Mem. M. C. Z., **22**, p. 29, f. 30; Jordan, 1887, Cat. fish. N. Amer., p. 11; Günth., 1887, Challenger rept. Zool., **22**, p. 10.
Raia laevis Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 71.

" A remarkable species with back and ventral surface covered with minute sharp granular ossifications, obtained by Capt. Joseph W. Collins on Le Have

Bank. A species of the same type as *R. laevis*, and having 30–31 teeth on each side; the back granulated and slate-colored; the ventrals distinguished by reticulate markings, and the claspers slender and scarcely expanded." (Gill's MS.)

Western North American species.

Raia aleutica.

Raia aleutica Gilbert, 1895, Rept. U. S. fish. comm. for 1893, p. 397, pl. 21; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 75.

Disk rhomboid, wider than long, front angle 90° or more, outer angles greater, rounded, hinder angles and margins broadly rounded, anterior margins undulated. Snout long, nearly one third as long as the disk without the ventrals, blunt. Eyes small, length about half the interorbital width, the latter being two sevenths of the distance from the end of the snout. Teeth in $\frac{38}{43}$ rows. Back and tail with close-set stellate spines, larger in front of the eyes, on the snout and in a wide band on each side of the tail. A strong tubercle on each shoulder, a median vertebral row of tubercles (34) from the head to the second dorsal. Lower surfaces smooth. Tail less than half the total length.

Brown with large obscure dusky blotches; below white, edges of disk and around the vent brown.

The type a young male of nearly 34 inches in length was taken off the Aleutian Islands, in 81 fathoms.

A second specimen described with the type may be of another species: — its forward angle was given as about 100°, the rows of teeth $\frac{32}{28}$, and the greatest width of the disk 48 inches.

Raia kincaidii.

Plate **17**^{b}, fig. 3.

Raia kincaidii Garman, 1908, Bull. M. C. Z., **51**, p. 254.

Disk subcircular, front angle very obtuse, anterior margins not indented; snout short, blunt, hardly produced; outer and hinder angles and hinder margins broadly rounded. Mouth moderate, curved forward in the middle, width less than half the length of snout; teeth comparatively large, in about 33 rows, crowns flattened with a slightly raised sharp angle on the inner margin. Ventrals broad, notch of medium depth. Tail as long as the disk, tapering gradually to slender, produced behind the dorsals, with a rudimentary caudal fin. Dorsals separated by a space with spines. Back and tail covered with small sharp

closely set hooked scales. A vertebral row of striate-based compressed tubercles from head to second dorsal; a single tubercle above each shoulder. No tubercles around eyes or spiracles. Lower surfaces smooth.

Upper parts uniform slaty brown or leaden with numerous small spots of black; a light spot on each side of the tail behind the ventrals and a fainter one behind each shoulder on the pectorals.

Total length 12, tail 6, and greatest width $7\frac{1}{8}$ inches.

Type secured in Friday Harbour, Washington, by Dr. Trevor Kincaid.

Raia trachura.

Raia trachura Gilbert, 1892, Proc. U. S. nat. mus., **14**, p. 539; 1895, Rept. U. S. fish comm. for 1893, p. 398; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 75.

Disk broader than that of *R. isotrachys*, snout blunter, front angle greater than 90°, outer angles broadly rounded, anterior margins strongly undulated convex at the snout. Snout angle about 120°. Interorbital space concave, width little more than length of eye, about one third the length of the snout. Teeth small, with a minute cusp. Tail little longer than the body. Upper surfaces sparsely but evenly roughened by small stellate-based spines, which are closer set on the interorbital space, along the anterior margins, behind the shoulders and on the sides of the tail. No tubercles on the orbital ridges or the shoulders; a single small tubercle on the middle of the back, above the shoulder girdle, and a median series of tubercles on the tail.

Back plumbeous, darker at the margins. Lower surfaces brown, lighter on the body, blackish on the margins of pectorals and ventrals.

Type 18 inches in length, taken in Lat. 32° 40′ 30″ N., Long. 117° 31′ 30″ W., in 822 fathoms.

Santa Barbara Channel, off the coast of southern California.

Raia abyssicola.

Raia abyssicola Gilbert, 1895, Rept. U. S. fish comm. for 1893, p. 396, pl. 20; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 76.

Disk rhomboid, wider than long, front angle less than 90°, outer angles greater, rounded, anterior margins nearly straight, hinder broadly rounded. Width of mouth more than half its distance from the end of the snout. Teeth in 31 rows. Eyes small. Tail slender, tapering, little more than half the total length, lateral folds wide. Dorsals separated by a space with a spine. Claspers long, slender, flexible, enlarged at the ends. Tenacula in a band near the outer

angle, nearly parallel with the hinder margin, in irregular series. Skin rough with close-set setiform spines, absent from the anterior and the posterior margins, the orbital region, the greater part of the tops of the ventrals, and the lower side of the base of the tail, larger along the sides of the tail. No larger spines on the orbital ridges. A vertebral series of broad based tubercles on back and tail, interrupted above the body.

Uniform brown above and below, back obscurely marked anteriorly by small spots of darker with definite margins.

Type a male, 45 inches long, taken off the Queen Charlotte Islands, British Columbia, in a depth of 1588 fathoms.

Raia parmifera.

Raia parmifera Bean, 1881, Proc. U. S. nat. mus., **4**, p. 157; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 878; Gilbert, 1895, Rept. U. S. fish comm., for 1893, p. 395; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 74.

Disk broader than long, tip of snout slightly produced, anterior margins undulated, posterior convex, width equal entire length behind the shoulder girdle. Internarial width about two thirds and interorbital width about two sevenths of their respective distances from the end of the snout. Mouth slightly arched; teeth with a short rather sharp median cusp, in about 26 rows. Tail shorter than the body; dorsals separated by a tubercle. Roughened by small spines on the crown, on the margins of the pectorals and the ventrals, on the base of the tail and, by larger ones, along the sides of the tail. A median series of tubercles (29) on back and tail. On the male the greater portion of the disk is smooth and tenacula appear near the outer angles; the claspers are slender and of more than half the length of the tail.

Olive-brown, with numerous indistinct lighter blotches, two of them larger, one enclosing a blotch of white as large as the eye. Two small blotches of light brown behind the ventrals on the tail.

Total length 38½, length of disk 20 and greatest width 27 inches.

Unalaska.

A close ally, perhaps a variety, of *R. stellulata*.

Raia interrupta.

Raia interrupta Gill & Townsend, 1897, Proc. Biol. soc. Washington, **11**, p. 232; Jord. & Everm., 1898, Bull. 47, U. S. nat. mus., p. 2751.

Snout moderate, blunt, rostral cartilage soft, narrow. Interorbital space concave. Mouth small, width equal half the length of the snout. Upper surfaces roughened by spinules, except on the end of the snout. No tubercles

on the orbital ridges. A tubercle on each shoulder, a median series of hooked tubercles behind the head to the dorsal, interrupted behind the first four to those on the tail.

Imperfectly known from the original description.

Bering Sea.

Raia rosispinis.

Raia rosispinis Gill and Townsend, 1897, Proc. Biol. soc. Washington, **11**, p. 231; Jord. & Everm., 1898, Bull. 47, U. S. nat. mus., p. 2751.
Raia obtusa Gill & Townsend, 1897, Proc. Biol. soc. Washington, **11**, p. 231.

Snout moderate, bluntish, rostral cartilage soft, narrow. Interorbital space nearly plane. Mouth small, width equal half the length of the snout. Borders of pectorals and ventrals naked. Snout with spinules, and with a number of stellate-based spines about the middle; larger spines scattered "between the disk and the pectoral rays." Two spines on each shoulder, one spine in front of and one behind each eye and "another behind it about half the distance." A median row of about 26 spines from near the head to the dorsal.

Bering Sea. (Gill and Townsend, *loc. cit.*).

Raia binoculata.

Raia binoculata Girard, 1854, Proc. Acad. nat. sci. Phil., p. 196; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 878; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 72.
Uraptera binoculata Girard, 1858, Rept. Pacif. R. R., Fish., p. 373.
Raia cooperi Girard, 1858, Rept. Pacif. R. R., Fish., p. 372; Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, p. 135; 1882, Bull. 16, U. S. nat. mus., p. 42.

Disk rhomboid, width nearly one third greater than the length of the body to the pores, front angle and outer angles nearly 90°, blunted, anterior margin undulated, somewhat indented, snout little produced, rounded. Mouth slightly arched, width more than half the length of the snout. Teeth small, with a low rounded keel ending in a point, in 48 rows. Eyes smaller than the spiracles, length near one third of their distance apart, or one sixth of that from the end of the snout. Minute spines roughen the upper surfaces and below the snout and the anterior margins. An irregular median series of small tubercles, or a narrow band, from above the abdomen, on the tail to the second dorsal. Young specimens smoother on the fins and below the disk, with a more regular median series of tubercles on the tail and with a single tubercle in front of and another behind each eye, another behind the head and commonly one on each shoulder. Tail depressed, length more than two thirds that of the body, dorsals separated by a space with spines.

Adults brown, clouded or with scattered spots of paler brown, dingy white below. Young reddish brown, with numerous spots of white and with a large rounded or oblong spot of blackish encircled by a ring of yellow surrounded by one of a darker yellow; beneath white, posterior margins of pectorals brown, and those of ventrals darker brown.

Total length of specimen described $30\frac{1}{2}$, snout to pores 18, snout to mouth $5\frac{1}{2}$, and greatest width 24 inches.

Individuals reach a length of more than six feet.

California and northward.

Raia inornata.

Raia binoculata Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, p. 134.
Raia inornata Jordan & Gilbert, 1881, Proc. U. S. nat. mus., **3**, p. 457; 1881, ibid., **4**, p. 74; 1882, Bull. 16, U. S. nat. mus., p. 878; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 73.
Raia jordani Garman, 1885, Proc. U. S. nat. mus., **8**, p. 43.
Raia inornata var. *inermis* Jordan & Gilbert, 1881, Proc. U. S. nat. mus., **3**, p. 457; 1881, ibid., **4**, p. 74.
Raia binoculata var. *inermis* Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 44.

Disk rhomboid, anterior margins inclosed in straight lines forming an angle little greater than 90°, outer angles obtuse, rounded, hinder angles and margins broadly rounded. Snout produced, narrow, blunted, length nearly one third of the greatest width of the disk. Mouth slightly arched, width one half or less of the length of the snout. Teeth small in 38 rows. Eyes large, length equal interorbital width, or less than one third of their distance from the tip of the rostrum. Spiracles smaller. Forehead transversely concave. Tail nearly half of the total length, slender, produced behind the second dorsal. Dorsals separated by a space with spines. No small spines on the disk; a pair of hooked tubercles in front of, a single tubercle at the middle, and two more behind each eye, and a median series from head to dorsals, continued above the abdominal region by much smaller ones. No tubercles above the shoulders. Females have lateral series on the tail.

Chocolate-brown of moderate depth, with a darker faint ring on the base of each pectoral; lower surfaces whitish, openings of pores dark.

Total length $9\frac{3}{8}$, snout to pores $4\frac{7}{8}$, snout to mouth $1\frac{5}{4}$, and greatest width 6 inches. Reaches a length of two feet or more.

The specimen described is young; it does not show the dusky spots on the pectorals and the ventrals, nor the spinules along the median series, on the head and on the snout.

Off coasts of southern California.

Raia stellulata.

Raia stellulata Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, p. 133; 1882, Bull. 16, U. S. nat. mus., p. 45; Gilbert, 1895, Rept. U. S. fish comm. for 1893, p. 396; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 75; 1900, ibid., Atlas, pl. 11, f. 32.

Disk rhomboid, broader than long, snout slightly produced, blunted, front angle more than 90°, outer angles little less than the front angle, anterior margins undulated, hinder convex. Length of snout little more than twice the width of the interorbital space. Mouth arched; teeth in about 40 rows. Width of disk equal to length of body and tail behind the shoulder girdle. Body roughened by small stellate spines that are stronger above the head and the snout, near the pectoral margins, along the middle of the body and at the sides of the tail. Stout spines on the middle of each shoulder and above the eyes. A median row of small tubercles behind the head on back and tail. Lower surfaces smooth, except below the snout. Males have the bases of the pectorals almost smooth and there are tenacula near the outer angles; this sex matures at a length of thirty inches or less.

Brownish with scattered ill-defined dusky spots, variegated with light and dark; an ocellate spot, surrounded by a pale ring inside of a black one, on each pectoral; numerous spots of black, some ocellate, scattered over the body; head with black cross bars.

As figured by Jordan and Evermann the disk is subquadrate, with the front angle about 90°, and the spots are the two large ones on the bases of the pectorals.

Off the coasts of California and northward.

Raia rhina.

Raia rhina Jordan & Gilbert, 1880, Proc. U. S. nat. mus., **3**, p. 251, 1882, Bull. 16, U. S. nat. mus., p. 45; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 72.

Shape resembling that of *R. stabuliforis*, Plate **22**, fig. 2. Disk little broader than long, snout elongate, about one third of the length of the disk or four times the interorbital width, acuminate, front angle less than 90°, anterior margins undulate, deeply concave, outer angles about 90°, blunted, hinder margins and angles broadly rounded. Mouth arched, width nearly two fifths of the distance from the end of the snout; teeth small, in 42 rows (42–48). Eyes large, in length equal to the width between the orbits. Young smooth, with a band of minute spines along the lower front margins and under the snout, with a strong hooked tubercle in front of and one behind each orbit, with a large median tubercle in front of the shoulder girdle, and with an irregular series behind the

pelvis above the tail. On larger individuals the back is roughened by small stellate spines, more irregular and scattered on the males, larger in the central areas and opposite the eyes, and there is a row of small tubercles on each orbital ridge and a median series of several near the middle of the back which appears more or less complete from the abdominal region to the second dorsal. Tail little shorter than the body, dorsals separated by a space with spines. Reaches 30 inches in length. Specimen in hand in total length $8\frac{1}{4}$, snout to ventral pores $4\frac{1}{8}$, snout to mouth $1\frac{5}{8}$, and greatest width $6\frac{7}{8}$ inches.

Brown, nearly uniform; young with a dark rounded enclosure on the base of each pectoral and with scattered small spots of black; lower surfaces brownish, margins yellowish, pores black.

Off the coasts of the Pacific from California to Alaska.

Species from Japan to China and India.

RAIA FUSCA.

Plate **24**, fig. 4–5.

Raia fusca GARMAN, 1885, Proc. U. S. nat. mus., **8**, p. 42; JORD. & FOWLER, 1903, Proc. U. S. nat. mus., **26**, p. 649; PIETSCHMANN, 1908, Sitzb. Akad. wiss., Wien, **117**, p. 645.

Disk broad and broadly rounded, length nearly two thirds of the greatest width, anterior margins not indented, forming a wide curve in front, tip of snout a slight prominence, outer and hinder angles and hinder margins broadly convex. Snout moderate, less than twice the interspiracular width. Mouth medium, nearly straight, width less than half the distance from the end of the snout. Teeth flattened, inward edge sharp, in 34 rows. Length of orbits equal interorbital width or one third of preorbital length. Tail little longer than the body, produced behind the dorsals in a long point. Dorsals separated by a space with spines. Smooth above and below (very young), with two tubercles in front of and one tubercle behind each eye, a single larger one above the forward vertebrae, and a median series (14) behind the pelvis on the tail. No tubercles on the shoulders.

Chocolate-brown, with a dark ring half as wide as the mouth on the base of each pectoral behind the shoulder; lower surfaces yellowish white, brown below the outer half of each pectoral the edges of the ventrals and the greater part of the tail.

Total length of specimen described $4\frac{3}{4}$, snout to abdominal pores $2\frac{1}{4}$, and greatest width $3\frac{1}{4}$ inches.

Bay of Yedo, Japan.

Raia mammillidens.

Raia mammillidens Alcock, 1889, Ann. mag. nat. hist., ser. 6, **4**, p. 380; 1892, Ill. zoöl. Investigator, pl. 8, f. 1; 1899, Cat. deep-sea fishes Indian mus., p. 19.

Disk rhomboid, width or length, including the ventrals, about half of the total length; angles rounded, anterior and outer greater and hinder less than 90°; anterior margins slightly waved and but little convex; angle at the snout nearly 90°, blunted. Snout short, length less than one fourth of the width of the disk, little more than the distance between the outer margins of the nostrils. Length of orbit equal width of interorbital space. Mouth arched, crescentic; teeth of a female with a globular base and a mammillary point, in about 24 rows. Entire upper surface covered by small sharp close-set spines; lower surfaces smooth. A large spine in front of and another behind each eye, one above each spiracle, two or three above each shoulder, and a median vertebral series on back and tail. Dorsal fins slightly separated, tail little produced behind the second.

Uniform jet black, in spirits dark chocolate.

Type a female of $11\frac{1}{2}$ inches, from the Gulf of Menár, at a depth of 597 fathoms.

Raia porosa.

Raia porosa Günther, 1874, Ann. mag. nat. hist., ser. 4, **13**, p. 154.

Allied to *Raia marginata*. Width of disk much more than its length, including the ventrals; anterior margins undulated; front part of snout abruptly contracted into a narrow thin appendage. Teeth in 54 or 56 rows, pointed in male, flat in the female. A series of spines on each orbital ridge; rostral process with small stellate spines; a series of three or four spines on the median line of the back behind the head. Tail with three series of spines on the male and five on the female. Male with tenacula near the outer angles of the disk, with large spines on each side of the head, and with the anterior margins of the disk covered with small spines on its upper side in its whole length; female smooth in the parts just mentioned, with a broad band of small hooks along the upper side of the hinder margins.

Skin of lower part of snout and of throat with many large pores white in the centre and edged with black. Upper parts brown, snout white; lower parts whitish, tinged with brown.

Two specimens, male and female, adults, 11 inches in length, from China.

Raia kenojei.

Plate **24**, fig. 1–2.

Raia kenojei Müller & Henle, 1841, Plagios., p. 149, pl. 48; Richardson, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 197; Schlegel, 1850, Jap. Pisces, p. 308; Bleeker, 1857, Act. Soc. sci. Ind. Neerl., **3**, p. 42 part; 1860, ibid., **8**, p. 65; Duméril, 1865, Elasm., p. 556; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 461; Nyström, 1887, K. Svensk. vet. akad. handl., **13**, p. 51; Ishikawa & Matsuura, 1897, Cat. fishes, p. 60; Jord. & Snyder, 1900, Proc. U. S. nat. mus., **23**, p. 337; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 652; Pietschmann, 1908, Sitz. Akad. wiss. Wien, **117**, p. 646.

Raia meerdervoortii Bleeker, 1860, Act. Soc. sci. Ind. Neerl., **8**, p. 66; Jord. & Snyder, 1900, Proc. U. S. nat. mus., **23**, p. 337; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 650, fig. 7; Pietschmann, 1908, Sitz. Akad. wiss. Wien, 117, p. 642.

Raia japonica Nyström, 1887, K. Svensk. vet. akad. handl., **13**, p. 52.

Disk rhomboid, broader than long, very blunt-angled in front, outer and hinder margins and angles broadly rounded, anterior margins scarcely indented opposite the spiracles. Snout short, about one and one half times the width of the mouth, tip produced, rounded. Mouth large, undulated, width two thirds of the length of the snout. Teeth small in 50 (42–50) rows, the crowns in a low rounded keel ending in a sharp corner on the inward edge. Eyes and spiracles rather small, their combined lengths nearly half the snout, or little more than the interorbital width. Tail strong, short, less than length of body. Dorsals separated by a space with tubercles. Body nearly naked, a few minute spines along the anterior margins near the outer angles and below the edge of the snout. Tubercles small, compressed, hooked: a pair of very small ones in front of each orbit, a larger one opposite its middle and another behind it, two median tubercles behind the head in front of the shoulder girdle, and a median and four (2–4) lateral rows on the tail.

Rusty brown profusely sprinkled with small spots of brown, in cases forming rings or vermiculations, uniting in a large rounded inclosure on each shoulder, behind which one or two smaller rings frequently occur. Lower surfaces dingy white, brownish near the outer margins; pore openings below snout and gills dark.

Specimen described from the Idzu Sea, Japan, Alan Owston. Total length $17\frac{1}{2}$, snout to the abdominal pores 9, snout to mouth $2\frac{1}{4}$, and greatest width 12 inches.

Raia hollandi.

Raia hollandi Jordan & Richardson, 1910, Mem. Carnegie mus., 4, p. 163, pl. 64.

Disk including the ventrals subquadrate. Snout sharp pointed, slightly produced, rostral cartilage converging regularly to the end. Anterior margins

nearly straight, undulation slight; outer angle blunt, hinder margin broadly convex, hind angles broadly rounded. Interorbital space concave, width three elevenths of the length of the snout. Mouth slightly curved, width about five eighths of the rostral length. Teeth small, in about forty-five rows on the upper jaw. Ventrals deeply notched. Dorsals separated from one another more than the length of the first dorsal, length of tail behind the second dorsal one half more. Back with a row of eight or ten small tubercles on each orbital ridge, a single tubercle behind the occiput, and five irregular rows of small tubercles directed backward on the tail; lower surface with small spines below the head; elsewhere the body is smooth.

Brownish, back and fins closely sprinkled with dots of darker brown.

Disk to ends of pectorals $8\frac{1}{4}$, tail 7, and width of disk 10 inches in the type, a female, from Takao, Formosa.

Raia andamanica.

Raia sp. nov. Annandale, 1909, Mem. Ind. mus., **2**, p. 3.
Raia andamanica Lloyd, 1909, Mem. Ind. mus., **2**, p. 140; Ill. zoöl. Investigator. Fishes, pl. 46, f. 2.

Disk little broader than long; anterior margins sinuous, meeting in an angle of 90°; outer and hinder angles rounded, latter broader; hind borders slightly convex. Body two thirds as long as the tail, from the vent. Rostral cartilage moderate, ridges slightly convergent, but not meeting. Greatest diameter of the eye little more than the interorbital width, one fourth the length of the snout. Mouth little curved, width one third of the length of the snout. Teeth in $\frac{54}{40}$ rows, each with a low pointed cusp, if not worn away. Dorsals near the end of the tail, separated from one another by a short space. Back rough with small spines, which are larger opposite the eyes on the pectorals and above the sides of the tail. An irregular group or band of small tubercles above the rostral cartilage, a row of about eight around each orbital ridge, and a vertebral series, from the back of the head to the dorsal fin, broken above the abdomen. Lower surfaces nearly smooth.

Type a male of 21 cm.

Andaman Sea, at 279 fathoms.

Raia philipi.

Raia philipi Lloyd, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 306; 1907, Rec. Indian mus., **1**, p. 5; 1909, Ill. zoöl. Investigator, Fishes, pl. 40, 41, f. 1.

Disk including the ventrals as long as wide, anterior margins sinuous, front angle about 85°, snout slightly produced, outer angles greater than 90°, blunted, hinder angles broadly rounded, hind margins in greater part slightly convex. Interorbital width more than three times in the snout length. Spiracles as large as the eyes. Back roughened by spinules above the end of the snout and the pectoral margins opposite the gills. Orbital ridge with four spines in front and three behind. A median series of five spines behind the head. Male with tenacula. Top of tail with three somewhat irregular series of large spines, sides of tail rough with small ones. Second dorsal distant its length from the first. Tail as long as the body to the vent, slender, produced behind the dorsals.

Back brown, with a dark ocellus surrounded by a paler ring on the base of each pectoral. Lower surface of disk white, of tail with dark mottlings.

Type a nearly mature male about 14 inches (36 cm.) in length, in greatest width about 9 (23 cm.), from the Gulf of Aden, in 130 fathoms.

Raia powelli.

Raia powelli Alcock, 1898, Ann. mag. nat. hist., ser. 7, **2**, p. 145; 1899, Ill. zoöl. Investigator, pl. 26, f. 4; Cat. deep-sea fishes Indian mus., p. 20.

Disk rhomboid, excluding the ventrals nearly one half of the total length including the ventrals about equal the greatest width; each angle little greater than 90°, rounded; snout narrowly produced beyond the angle of anterior margins, length about two sevenths of the width of the disk; anterior margins slightly waved. Length of orbit hardly equal width of interorbital space. Mouth straight; teeth, in females, obtusely pointed or obscurely tricuspid, in about 55 rows. Disk smooth on both surfaces, excepting small spines near the edge of the snout, along the edges of the anterior halves of the pectorals, the top of the tail, two or three larger spines anteriorly on the orbital ridge, one behind the orbit, three in the middle line of the nape from the shoulder girdle, and two or three series from above the abdomen backward to the second dorsal. Dorsals separated by the length of a fin, tail produced behind the second dorsal. The outer angles of the pectorals appear to be about opposite the shoulder girdle.

Warm brown with a large ocellus of light color surrounded by a dark ring included in a light one on the base of each pectoral; lower surface dingy white.

Type a female of $12\frac{1}{2}$ inches from the Gulf of Martaban in 67 fathoms.

Raia isotrachys.

Raia isotrachys Günth., 1877, Ann. mag. nat. hist., ser. 4, **20**, p. 434; 1887, Challenger rept., Zoöl., **22**, p. 7, pl. 3.

In the figure of the type the anterior angle is nearly 90° and includes the forward two thirds of the disk. Snout elongate, pointed, about two and one half times the width of the mouth. Anterior margins very long, outer margin short. Forward ends of pectorals narrow, elongate, and, in the figure, reaching the tip of the snout. Outer and hinder angles rounded. Mouth small; teeth small, sharp. Tail little longer than the body, extended behind the second dorsal. Back and top of tail rough with minute stellate-based spines. No spines on the superciliary margins. A small spine on the middle of the back; a series of stronger ones (18) along the median line of the tail, none on the sides.

Upper parts brownish grey; lower smooth, brownish black.

Snout to vent 10, length of snout 3, tail $12\frac{1}{2}$, and width of body 13 inches.

South of Japan in 365 fathoms (Challenger Station 235).

Raia reversa.

Raia reversa Lloyd, 1906, Ann. mag. nat. hist., ser. 7, **18**, p. 311; 1908, Ill. zoöl. Investigator, Fishes, pl. 39, pl. 41, f. 2.

Disk rhomboid, width little greater than the length without the ventrals, anterior margins sinuous, indented, front angle about 80°, snout produced blunt, outer and hinder angles and hind margins broadly rounded. Interorbital width four times in length of snout from eye or mouth. Spiracles as large as the eyes. Mouth arched, in width half the length of the snout. Teeth in 42 rows, median long, curved, with cordate bases. Skin over the skull and near the margins of the pectorals, except posteriorly, roughened by spinules; none on the snout. A group of larger spines opposite the eye on each pectoral, a stellate spine in front of and one or more behind each eye, three spines above the gills in a triangle with apex median behind the head, a median series, somewhat interrupted from shoulder girdle to dorsal, and a lateral row about twice as numerous at each side of the median on the tail; sides of tail spinose. Lower surfaces smooth. Dorsals in contact. Two rows of tenacula (male). Body soft and flabby.

Back white shading into dark grey at the margins, ventrals grey; lower surfaces black.

Type a male of 24 inches (60 cm.) in length, and about 13 inches (33 cm.) in greatest width, from the Arabian Sea, off the Baluchistan Coast, in 820 fathoms.

Raia johannis-davisi.

Raia johannis-davisi Alcock, 1899, Cat. deep-sea fishes Indian mus., p. 121, Ill. zoöl. Investigator, pl. 27, f. 2.

Disk rhomboid, without the ventrals nearly half the total length, width more than its length including the ventrals. Anterior and outer margins nearly straight, outer angles nearly 90°, hinder angles very broadly rounded. Snout produced acuminate, length little more than one fourth of the width of the disk. Mouth straight; teeth blunt-pointed (male), in about 32 rows. Disk and tail smooth on both surfaces, excepting some star-shaped spines below the rostral cartilage and on the edges of the snout and the front ends of the pectorals, two strong spines in front of and one behind each orbit, a very strong spine in the middle in front of the shoulder girdle, and a median series of spines on the tail to the second dorsal. The outer angles of the disk appear farther backward than the shoulder girdle.

Smoky black above, black mottled with white below.

Type a male $8\frac{1}{4}$ inches in length taken off the Travancore Coast in 224–284 fathoms.

Raia tengu.

Raia tengu Jordan & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 654.

Disk rhomboid, broader than long, front angle acute, outer angle about 90°, anterior margins undulate, deeply concave near the snout, hinder margins somewhat convex. Snout long, slender, sharp, length nearly one third of the width of the disk. Eyes small, two ninths of the interorbital width. Mouth large, arched; teeth in 38 rows. Spiracles smaller than the eyes. Tail less than half the total length, produced behind the second dorsal. Dorsals separated by a space with spines. Back roughened by small spines; some above the snout, some on the orbital ridges, several on the back of the head, a median row of small tubercles from the pelvis backward, and a lateral row on each side of the tail; lower surfaces, especially in front, roughened, excepting tail and ventrals.

Brown above and below with small spots of lighter brown; lower pores blackish.

Type 44 inches in length, from Matsushima Bay.

Young with a shorter snout, and with a pair of tubercles in front of and a single tubercle behind each orbit, one behind the head on the middle of the back, and a median row on the tail, elsewhere smooth.

Coasts of Japan, not rare, especially to the northward.

Raia chinensis.

Raia chinensis Basilewsky, 1855, Ichth. Chin. Bor., p. 251 (non *La Raie chinoise* Lacépède, 1788; *Rhina sinensis* Schneider, 1801).

Corpus supra cinereum, subtus albicans, Rajae Batis simile, capite supra aspero, rostro longato acuminato, subtus marginibus ab apice ejus usque ad pinnarium pectoralium primam tertiam partem dentibus aculeatis et curvatis instructo.— Maxillae dentibus robustis, planiusculis sed parvulo hamulo praeditis armatae, Cauda carnosa, subcompressa, sursum per totum tractum scutis anterioribus obtusis, posterioribus acutis, apicem prope appendice pinnata parvula, ad basin pinna caudali (in utroque latere) carnosa, bifida, praedita, disci longitudine brevior. Dorsum antrorsum uno scutello obtuso, caput in singulo osse supraorbitali duobus scutellis. Anum aculeo longitudine usque ad 1–2 pollices, vulnera mortifera efficiente, praeditum, ideoque apud praedatum piscem semper deliberatum esse ab eo Chinensibus dicitur. Habitat in Mare orientali, provinciam Shan-dun alluente. Pekini rarissime occurrit. Longit. disci cum cauda 1 pes et 8 poll. Latitudo 1 pedis et 2 poll.

Not recognized since the original description.

South American species.

Raia extenta, nom. nov.

Raia erinacea Ribeiro, 1907, Arch. Mus. nac., **14**, p. 176, pl. 12, 13 (non *Raia erinacea* Mitchill).

Disk shaped somewhat like that of *R. erinacea*, Plate **20**, but snout shorter, tail much longer and more slender. Outline concave opposite the spiracles, convex opposite the eyes; snout short, length hardly greater than the interspiracular width. Mouth waved; teeth in about 44 rows. Tail long, about one and one half times the body, slender, tapering, extended behind the dorsals.

Back rough with small spines; larger tubercles grouped on the snout, opposite the eyes, around the orbital ridges, in a triangular area in front of the shoulder girdle, along the anterior margin of the pectorals and in two or more rows along the middle of the back; the median series of the back and tail is irregular; on the tail there are two or more lateral series. Smoother spaces occur above the abdomen, the basal and hinder portions of the pectorals, and above the gills. The claspers of the male are of moderate length, slender and pointed; tenacula are present near the outer angles. Adult about 9 inches.

Brown with small spots of darker and of lighter. Ribeiro figures the male and also a female profusely spotted with small spots of darker, and with numerous small spots of whitish.

Rio Janeiro.

Raia equatorialis.

Raia equatorialis Jordan & Bollman, 1890, Proc. U. S. nat. mus., **12**, p. 150, Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 74.

Disk, without the ventrals, broader than long, width greater than length of tail from the vent, anterior margins concave opposite the eyes. Snout produced, rather acute, rounded on the tip, length less than one third of the width of the disk. Interorbital space transversely concave, its width five twelfths of the snout length. Width of mouth two thirds of the snout from the nostrils. Teeth in $\frac{42}{40}$ rows. Back roughened by small spines near the anterior margins, above the snout, on the top of the head, by stronger ones or small tubercles in two rows on the rostral cartilage, on the orbital ridges, opposite the eyes, and in a lateral row at each side of the tail, and also by a median series of alternating sizes of tubercles on back and tail. A tubercle on each shoulder. Male with tenacula.

Back light brown, in obscure reticulations, spotted with paler, a dusky blotch on the middle of the base of each pectoral and a darker one farther back. Edges of pectorals, ventrals and snout pale. Dark markings on the head and below the eye. Lower surfaces plain.

Type a male of 14 inches, taken between Panama and the Galapagos Islands at a depth of 33 fathoms.

Raia badia.

Raia badia Garman, 1899, Mem. M. C. Z., **24**, p. 22, pl. 6, f. 1–2.

Disk rhomboid, wider than long, front angle about 90°, lateral angles rather less, anterior margins undulate, little indented, hinder margins nearly straight. Snout slightly produced, blunt. Mouth wide, width four fifths of distance from end of snout, arched; teeth small, not closely set, with a sharp cusp, in 44 rows. Eye small, two fifths of the interorbital space; orbits one fourth of the length of the snout. Spiracle smaller than the eye. Tail slender, tapering, with narrow lateral folds, produced behind the dorsals. Dorsals close together. Back roughened by small spines, intermixed with larger, slender, acuminate spines

over the pectorals and at the sides of the dorsal row. A group of small tubercles above the end of the snout; larger tubercles, with swollen ribbed bases and long sharp apices, in a median row on back and tail, in a group of three on each shoulder and in a pair above each spiracle; a single tubercle in front of each eye. Lower surfaces smooth.

Chocolate-brown above and below; narrow white areas about the mouth, and a white spot immediately behind the middle of the shoulder girdle.

Total length $10\frac{1}{8}$, snout to ends of pectorals 5, snout to ends of ventrals 6, and greatest width $6\frac{3}{4}$ inches.

Lat. 7° 05′ 30″ N.; Long. 79° 40″ W. Albatross 1891 Expedition, at 1270 fathoms.

Raia aguja.

Raia aguja Kendall & Radcliffe, 1912, Mem. M. C. Z., **35**, p. 78, pl. 1, fig. 1, 2.

Disk rhomboid, subquadrangular, little wider than long, anterior margins nearly straight, meeting in an angle of 97°, outer and hinder angles rounded, hinder margins very broadly curved. Snout long; rostral cartilage slender. Length of orbit about equal width of interorbital space, nearly one third of the distance from the end of the snout. Width of spiracle less than length of orbit. Nostrils small, valve produced in a lateral angle. Mouth large, straight, width equal that of internarial space, which is about half of the preoral length of the snout. Teeth small, in $\frac{33}{33}$ rows, each tooth with a flattened crown, transversely elliptical in outline, from which a small sharp point extends toward the throat. Ventrals deeply notched anterior portion narrow with several notches on the hinder edge. Tail shorter than the body, depressed, moderately slender, with a dermal fold along each side. Dorsals small, rounded on the margins, inserted on the hindmost fourth of the tail, separated from one another by a space about equal a basal length, and distant from the end of the tail nearly one length of a dorsal fin. Scales small, sharp, hooked, loosely placed, larger and closer together at each side of the top of the tail, along the middle of the body and above the forward portion of the disk and the head. A vertebral row of 26 small compressed hooked tubercles on the tail from the body to the dorsal; no other tubercles on head or body (young).

Total length $11\frac{1}{8}$, snout to ends of pectorals $6\frac{1}{4}$, snout to abdominal pores $5\frac{1}{2}$, snout to ends of ventrals $6\frac{3}{4}$, snout to mouth $1\frac{3}{4}$, tail from axils of ventrals $5\frac{1}{8}$, and greatest width $7\frac{1}{8}$ inches.

Dark chocolate-brown, little lighter below, apparently uniform; lips and mouth white.

Description from one of the types obtained by the Albatross 1904–1905 Expedition off Point Aguja, Peru, Lat. 5° 47′ S.; Long. 81° 24′ W., at a depth of 536 fathoms.

Raia microps.

Raia microps Günther, 1880, Challenger rept. Zool., **1**, p. 12, pl. 4; Berg, 1895, An. Mus. nac., Argent., ser. 2, **4**, p. 14; Evermann & Kendall, 1906, Proc. U. S. nat. mus., **31**, p. 70.

Disk broader than long, obtuse in front, anterior margins straight, outer and hinder angles and margins broadly rounded. Snout short, tip not produced. Mouth curved, width less than half the distance from the end of the snout. Teeth obtuse, in about 40 rows. Ventrals notched, anterior section large. Dorsals separated by a space with a spine, not reaching as far back as the end of the tail. Tail moderate, longer than the body. Minute spines on the snout, the interorbital space, and along the middle of the back and the front margins of the pectorals. A single spine on the middle of the back, and a series of spines on the median line of the tail. Openings of tubes behind the head arranged in fan-shape.

Total length $15\frac{3}{4}$, snout to vent $7\frac{1}{4}$, and greatest width 11 inches. An adult female measured 23 inches in greatest width.

Back brown; lower surfaces white.

La Plata River, Station 321, 13 fathoms.

Raia lima.

Raia lima Poeppig, 1835, Reise in Chili, **1**, p. 148; Duméril, 1865, Elasm., p. 553; Philippi, 1892, An. Mus. nac. Zool., **1**, Chile, p. 2 extra, pl. 1, f. 3; Delfin, 1901, Cat. peces Chile, p. 23.
Raia chilensis Steindachner, 1898, Zool. jahrb. Suppl., **4**, p. 332, pl. 21, f. 15.
Raia bürgeri Delfin, 1902, Rev. Chil., **6**, p. 267, pl. 12.
Raia steindachneri Fowler, 1910, Proc. Acad. nat. sci. Phil., **62**, p. 468.

Disk rhomboid, broader than long, blunt angled in front; snout slightly produced; anterior margins waved, nearly straight, little concave in the middle, outer angles blunted, hinder angles and margins broadly rounded. Lateral teeth blunt, median sharper. Outer edges of nostrils distant from end of snout one and one half times their distance from one another. A band of small spines along the middle part of the forward margins of the pectorals, opposite the eyes; top of head rough with minute spines, a larger spine in front of and another behind each eye, a vertebral row of small tubercles on the middle of the body,

absent over the abdomen, continued on the tail. On the body there is a median band of very small spines. Tail shorter than the body, dorsal fins near the end and separated from one another by a space.

Dull greyish violet, faintly and sparsely mottled with darker.

Total length nearly 12.44, length of body 6.69, length of snout 1.69, and greatest width about 9.37 inches.

Near Iquique, Chile.

Raia brachyurops.

Raia brachyura Günther, 1880, Challenger rept. Zool., **1**, p. 20, pl. 6; Vaillant, 1888, Cap. Horn. Poissons, p. 14, pl. 2, f. 1–1^{b} (non Lafonte, 1873).
Raia brachurops Fowler, 1910, Proc. Acad. nat. sci. Phil., **62**, p. 468.

Disk broader than long, anterior angle obtuse, anterior margin concave toward the outer angle, outer and hinder angles and margins broadly rounded. Width of interorbital space less than distance from eye to end of snout, or more than length of orbit plus spiracle. Mouth nearly transverse; teeth pointed, in about 35 rows. Ventrals deeply notched, anterior portion small. Tail stout, shorter than the body, slightly produced behind the dorsals, which latter are separated by a short space with a spine. Back rough with minute spines; a median series of conical tubercles on back and tail.

Brown marbled with darker and lighter.

Total length, of male, $27\frac{1}{4}$, snout to vent $14\frac{1}{2}$, and greatest width $18\frac{1}{2}$.

Total length, of female, $32\frac{1}{2}$ snout to vent 18, and greatest width 25.

Magellan Straits and westward, Station 313 in 55 fathoms and Station 314 in 70 fathoms.

Raia magellanica.

(?) *Raia magellanica* Philippi, 1902, Rev. Chil., **6**, p. 59.
Raia magellanica Steindachner, 1903, Zool. jahrb., Suppl., **6**, p. 212.

Disk little broader than long; snout somewhat produced; anterior margins slightly concave in the middle third of their length, more strongly convex toward each end; outer angles more bluntly rounded than the hinder. Teeth with a short point. Back with small sharp spines. A tubercle in front of and another behind each eye; at each side of the median row nearly above the shoulder girdle a row of three, anterior nearer the middle and stronger. Behind the shoulder girdle at each side of the median row there are three to four rows of smaller tubercles, continued on the top of the tail. Lower surfaces smooth. Dorsals separated by a narrow space.

Back greyish violet, with rounded or oval greyish yellow spots, some of which are surrounded by a dark ring.

Total length 48.2, length of disk 29.5, length of tail 21, and greatest width 33 cm.

Another specimen somewhat larger, a male, had deeper concaves in the anterior margins, which were more sinuous, and had a group of larger spines on the front portion of each pectoral. Its total length was 60.3, length of tail 27.3, and width of disk 40.5 cm.

Punta Arenas, Magellan's Strait.

Raia flavirostris.

Raia flavirostris Philippi, 1892, An. Mus. nac. Zool., **1**, Chile, p. 3, extra, pl. 1, f. 2.
Raia oxyptera Philippi, 1892, ibid., p. 4, pl. 2, f. 1.
Raia latastei Delfin 1902, Rev. Chil., **6**., p. 264, pl. 11.

Disk rhomboid, wider than long, front angle acute, outer not rounded, front margins undulate, indented, hinder margins and angles broadly rounded. Snout nearly one third of the length of the body, acute. Teeth in about 40 rows. Tail less than half the total length. Back roughened by small spines, larger on the head and the margins of the pectorals. Three rows of tubercles on the tail, median row originating farther forward than the others. Philippi's figure of the type, a female 30 inches in length, shows five or six small tubercles at each side of the abdomen and three more on each ventral. Probably to be placed with *R. patagonica*.

Raia oxyptera, described from an adult male of about 42 inches, has 38 rows of teeth, three rows of tubercles on the tail, with coarse spines above the rostral ridges, in a group in front of each eye and in another group opposite the eye on each pectoral margin, in addition to the tenacula near the middle of the pectoral and the claspers. Excepting, possibly, the spines on the abdomen and the ventrals, which may be peculiar to an individual, a sex, or a species, the differences in the types described as *R. flavirostris* and *R. oxyptera* do not appear greater than may be accounted for by difference in sex and age.

Coast of Chile.

Raia castelnaui.

Raia agassizii var. *meta* Ribeiro, 1904, Pescas do "Annie," p. 20.
Raia agassizii var. *picta* Ribeiro, 1904, Pescas do "Annie," p. 19.
Raia castelnaui Ribeiro, 1907, Arch. Mus. nac., **14**, p. 177, pl. 15.
Raia agassizii ribeiro Fowler, 1910, Proc. Acad. nat. sci. Phil., **62**, p. 468.

Width of disk less than three fourths of its length; front angle nearly 100°; snout pointed, not produced; anterior margins sinuous; outer angles blunted;

hind margins little convex; hind angles rounded. Orbit more than one half of the interorbital width, or nearly one fifth of the preorbital length. Mouth wide, width about three fifths of the preoral length, somewhat curved forward in the middle. Outer lobes of palatal velum hardly developed, median notch deep. Teeth small, crown flattened, hind edge sharp, more often angled toward the throat, in $\frac{44}{47}$ rows. Top of disk and lower surface of snout rough with small spines, rather loosely placed, larger on the head and along the middle of the back and tail; a row of still larger ones, or small tubercles on each orbital ridge; a row of eighteen compressed backward-directed tubercles on the median line of the tail from the body to the second dorsal, three of them in the interdorsal space. This median row no doubt extends forward on the body on large individuals. Tail from the pores half of the total length, shorter than the pectorals; lateral folds prominent. Dorsals rather large, on the hindmost third of the length of the tail, separated from one another by little more than the base of the first. Base of second dorsal equal two thirds of its distance from the end of the tail.

Total length of specimen here described 22 inches, snout to abdominal pores 11, and greatest width 15 inches.

Rusty brown, sprinkled on head and disk with small rounded spots of black; lower surfaces lighter; openings of pores black, above and beneath.

A large species, said by Ribeiro to measure more than a metre in length of disk when fully grown.

Rio Janeiro.

Raia cyclophora.

Raia cyclophora Regan, 1903, Proc. Zool. soc. London, **2**, p. 60; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 178, pl. 16.

Snout with an obtuse triangular projection of moderate length. Anterior borders of pectorals emarginate. Eye-diameter two sevenths to one fourth of the distance from the end of the snout; equal to interorbital width. Mouth strongly curved; teeth in 36–38 rows. Body smooth, excepting a series of ten to eleven spines on the dorsal surface of the tail, and, on males, a double series of curved tenacula on each pectoral. Claspers of the male extending to below the first dorsal.

Brownish, with a conspicuous black circle on each pectoral near the middle of its base.

Types two specimens from Rio Janeiro; a female 480 mm. in total length, and a male of 410 mm.

Raia platana.

Raia platana Günther, 1880, Challenger rept. Zool., **1**, p. 11, pl. 3; Berg., 1895. An. Mus. nac. Argent., ser. 2, **4**, p. 13; Evermann & Kendall, 1906, Proc. U. S. nat. mus., **31**, p. 69.

Disk rhomboid, length of body about two thirds of its width, anterior and hinder angles little more than 90°, hinder angles broadly rounded, anterior margins nearly straight. Snout long, produced, pointed. Mouth strongly curved, width half length of snout; teeth pointed, in about 48 rows. Ventrals deeply notched, forward portion toothed on the edge; claspers of male, slender, pointed. Tail moderate, nearly as long as the disk, produced behind the dorsals, which latter are separated by a space with a spine. Upper parts smooth, excepting minute spines along each side of the snout and above the eyes, a row of small tubercles distally on the median line of the tail, and, on males, the bands of tenacula near the outer angles of the pectorals. Total length 25, snout to vent $13\frac{1}{2}$, and greatest width 21 inches. In the figure the tail is longer than the body.

Brownish above; whitish below.

Mouth of La Plata River, in 13 fathoms.

South African to New Zealand species.

Raia nitida.

Raia nitida Günther, 1880, Challenger rept. Zool., **1**, p. 27, pl. 14, fig. A.; Macleay, 1884, Proc. Linn. soc. N. S. Wales, **9**, p. 63.

Disk subcircular, broader than long, anterior angle blunt, outer angles and margins broadly rounded. Snout with a thin projection. Width of interorbital space less than length of orbit. Internarial width less than distance from end of snout. Teeth almost obtuse (juv.). Upper parts covered with minute spines; one or two curved spines in front of the orbit and one or two behind it, one on the middle of the back, and a series along the median line of the tail. Tail longer than body, extended behind second dorsal.

Above light brownish marbled with dark brown blotches bearing small round yellowish ocelli.

Type a male in total length 8, tail $4\frac{1}{2}$, and greatest width 5 inches, from Twofold Bay, southern Australia, in 120 fathoms.

Raia lemprieri.

Raia lemprieri Richardson, 1848, Erebus & Terror, Fish., p. 34, pl. 23; Duméril, 1865, Elasm., p. 552; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 463; Castelnau, 1872, Proc. Zool. & acclim. soc. Victoria, **1**, p. 224; Macleay, 1881, Proc. Linn. soc. N. S. Wales, **6**, p. 375.
Raia dentata Klunzinger, 1872, Archiv. f. nat., **38**, p. 46; Macleay, 1884, Proc. Linn. soc. N. S. Wales, **9**, p. 63.
Raia australis Macleay, 1883, Proc. Linn. soc. N. S. Wales, **8**, p. 461; Waite, 1899, Mem. Austr. mus., **4**, p. 40, pl. 4.

Disk broader than long; a continuation of the anterior margins would meet in a blunt angle beyond which the snout is slightly produced; anterior margin concave opposite the spiracle. Snout pointed, length nearly twice the interspiracular width. Mouth curved; teeth acutely sharp in males. Disk about half the total length. Upper parts rough with small spines, somewhat larger on snout, head, anterior margins, and top of tail; small tubercles in a group above the anterior extremities of the pectorals, in a row on the orbital ridge, in a vertebral series from head to dorsals more or less interrupted over the abdomen and anteriorly, in an irregular row or in two rows at each side of the median series on the tail. A band of erectile tenacula near the outer ends of each pectoral on males. The male is mature at a length of twenty inches.

Back brown to greyish brown; below white more or less blotched with brown, openings of pores black. The type originally described from Van Dieman's Land was blackish grey and had black on the end of the snout above and below, and under the tip of the tail, marks not mentioned in connection with Australian specimens; this may indicate varietal differences for the two localities, in which case the later described form will be known as *Raia lemprieri* var. *australis*.

Raia murrayi.

Raia murrayi Günther, 1880, Challenger rept. Zool., **1**, p. 15, pl. 5.

Disk broader than long, anterior angle nearly 90°, snout somewhat produced, anterior margins concave in the middle, outer and hinder angles and margins broadly rounded. Width of interorbital space equal to length of orbit. Mouth curved, width equal half the length of the snout; teeth pointed. Ventrals deeply notched, anterior portion small. Back and tail rough with small spines on young and females; disk much smoother on males. Male with tenacula near the outer angles of the pectorals. A tubercle in front of, and another behind each orbit, four to six in a triangle on the middle of the back, sixteen to eighteen

in a median series on the tail, and farther forward on young. Small tubercles on the sides of the tail.

Back brown with rounded darker and lighter spots; the male type with a large yellow black-edged ocellus on each side of the back.

Total length $17\frac{1}{2}$, body $8\frac{1}{2}$, and greatest width 11 inches.

Kerguelen Island.

Raia eatonii.

Raia eatonii Günther, 1876, Ann. mag. nat. hist., ser. 4, **17**, p. 390.

Allied to *Raia smithii*. Width of disk one and one half times the length of the body; anterior margins slightly indented, meeting at a right angle, outer angles rounded. Length of snout from the eyes moderate, equal to three and one half times the interorbital width. Teeth pointed, conical, in about 30 series on the upper jaw. Greater part of upper surface smooth. Minute spines between the eyes, in a narrow stripe along the margin of the body, and in a broad band along the median line of the back and the top of the tail. A single longer recurved spine on the middle of the back and a series of nine or ten widely spaced along the median line of the tail; no spines on the sides of the tail. Lower parts smooth. Male with tenacula.

Brownish black above, with indistinct round whitish spots; whitish below, with some irregular spots of brownish black; lower part of tail brownish black.

Total length $26\frac{1}{2}$, tail 14, and greatest width 18 inches.

Type an adult male, from Kerguelen Island.

Raia ocellifera.

Raia capensis Müller & Henle, 1841, Plagios., p. 151; Duméril, 1865, Elasm., p. 540; Kner, 1867, Nov. fische, p. 419 (non *capensis* Gmelin).
Raia ocellifera Regan, 1906, Ann. Natal mus., **1**, p. 2, pl. 2.
Raia rhizacanthus Regan, 1906, Ann. Natal mus., **1**, p. 3, pl. 3 (young).

Shape of disk resembling that of *R. clavata;* much broader than long, front angle obtuse, snout produced and sharper; anterior margins undulate, nearly straight, slightly convex opposite the eyes; outer angles blunted, hinder broadly rounded. Anterior ray of pectoral fins widely separated from the rostral cartilage. Distance between outer edges of nostrils less than length of snout. Mouth curved; teeth obtuse in females, more pointed in males, in about 50 rows, or less numerous in young. Back rough with small spines, absent from median parts of adult males, more numerous on females and young. Several spines in

front of and behind each orbit, a few above the snout and others opposite the eyes near the end of each pectoral; a median series, more or less interrupted above the body, from the head to the second dorsal. Besides being more spinose over the disk, the female and the young have one or more lateral series on the tail. Tail slender, longer than the body, produced behind the dorsals. Total length of the type 27, snout to vent $14\frac{1}{3}$, and greatest width 22 inches.

Brownish, spotted with lighter and with darker to nearly uniform, with a bluish black ocellus near the middle of the base of each pectoral, and in cases with a smaller one near the axils of these fins.

South Africa.

Raia smithii.

Raia smithii Müller & Henle, 1841, Plagios., p. 150, pl. 49, fig. 1; Duméril, 1865, Elasm., 553; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 467.

Disk rhomboid, length to width as 5 to 7, anterior angle obtuse, but snout long slightly produced and pointed, anterior margins somewhat undulated, outer and posterior angles blunted. Teeth in females with a pyramidal cusp or pointed keel, in 28 rows. Back rough with radiate-based spines, except on the body near the middle; orbital ridge with or without a spine in front; a series of strong spines along the median line of back and tail, no lateral series on the tail. Ventrals deeply notched, anterior portion narrow. Tail little longer than the body; dorsals separated by an interspace with a spine. Total length of the type 21 inches.

Dark brown above; white below.

South Africa.

Raia nasuta.

Raia nasuta Müller & Henle, 1841, Plagios., p. 150; Duméril, 1865, Elasm., p. 572; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 469; Hutton, 1872, Cat., p. 84; 1889, Trans. N. Z. inst., **8**, p. 276; Waite, 1909, Rec. Canterb. mus., **1**, no. 2, p. 18, pl. 19, 21, f. 2.

Raia oxyrhynchus Castelnau, 1872, Proc. Zool. & acclim. soc. Victoria, **1**, p. 224.

Raia rostrata Castelnau, 1873, Proc. Zool. & acclim. soc. Victoria, **2**, p. 57; Macleay, 1881, Proc. Linn. soc. N. S. Wales, **6**, p. 376.

Raia scabra Ogilby, 1888, Cat., p. 17.

Disk rhomboid, broader than long, sharp angled in front, outer angles blunted, hinder broadly rounded. Outlines somewhat like those of *R. stabuliforis*, Plate 22, fig. 2. Snout produced, acute. Mouth waved, width half the length of the snout; teeth sharp, in about 36 rows. Back rough with small spines. On large specimens the disk is smoother near the middle and on the

hinder parts of the pectorals. Three to six tubercles on each orbital ridge, two or three above each shoulder, one to three irregular series on the tail the median of which begins on the hind part of the body, in cases in a spine or spines farther forward. Tail two thirds as long as the body, produced behind the second dorsal.

Greyish brown, with spots and cloudings of darker and of lighter, to uniform brown, reddish about the head in life; lower surfaces white, openings of pores black.

Said to reach a length of more than seven feet.

New Zealand and Australia.

Uraptera.

Uraptera Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117.

Disk much depressed, pointed in front. Snout with a strong rostral cartilage and a wide translucent space. Pectorals extended in front of the cranium but widely separated at their forward ends. Mouth, teeth, and nostrils as in Raia. Tail elongate, slender, with a lateral fold on each side, and with two dorsals widely separated from one another and from the end of the tail. Ventrals deeply notched. Back and tail roughened with spines and tubercles.

Uraptera agassizii.

Plate **53**, fig. 1 (pelvis); Plate **68**, fig. 2 (skeleton).

Uraptera agassizii Müller & Henle, 1841, Plagios., p. 155, pl. 50, f. 2; Castelnau, 1855, Anim. nouv., Poiss., p. 100, pl. 49, f. 2; Duméril, 1865, Elasm., p. 573.
Raia agassizii Günth., 1870, Cat. fishes Brit. mus., **8**, p. 465; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 177, pl. 14.

Snout pointed. Disk rhomboid, in length to width as 9:11, front margin waved, outer angle blunted, hinder rounded, length of snout little more than width of internarial space. Eyelid somewhat produced. Teeth of male sharp. Tail slender; dorsals small, second separated from the first by a space nearly twice the length of its base, distance of second from end of tail equal length of dorsals and space between them, origin of first a short distance behind the middle of the tail. Back sometimes smooth. Most often there are small spines on the end of the snout, scattered between the eyes and the spiracles, on the middle of the back, and on the tail. Of tubercles there is one in front of each eye, one or two between each eye and the spiracle, sometimes absent. Many specimens

have behind the head and farther back a series reaching the tail; others have only small spines. The largest tubercles occur on the middle line of the tail in front of the dorsals. The lower surface is smooth, except below the snout.

Back uniform brown with or without a spot of lighter near each shoulder, and another near the hinder angle of each pectoral. The lower surface is white with the exception of an elongate spot of brown below the end of the snout.

A fully developed male has a length of about 16 inches, or from snout to pores $7\frac{1}{4}$, from pores to end of tail $8\frac{3}{4}$, and a greatest width of $8\frac{3}{4}$. It has $\frac{42}{44}$ rows of teeth, ten of the outward rows with flat crowns like the female, the others with a sharp cusp; the claspers are slender and long pointed and do not reach to the first dorsal by more than twice the length of the dorsal base. From the origin of the first dorsal to the end of the tail is $4\frac{1}{4}$ inches; from the base of the second dorsal to the end of the tail is $2\frac{1}{4}$ inches. The distance between the bases of the dorsals is more than twice the base of the first dorsal.

Rio Janeiro.

Dactylobatus.

Dactylobatus Bean & Weed, 1909, Proc. U. S. nat. mus., **36**, p. 459.

Disk subcircular, a few median rays of each pectoral produced beyond the others, snout produced. Anterior nasal valves reaching the mouth, joined to a wide isthmus. Ventrals deeply notched. Spiracles near the eyes, small. Tail elongate, depressed, with a lateral fold on each side, with two dorsals near the end and with a rudimentary caudal fin. Back roughened by spines and tubercles.

Dactylobatus armatus.

Dactylobatus armatus Bean & Weed, 1909, Proc. U. S. nat. mus., **36**, p. 459, pl. 38.

Disk rounded, broader backward, semicircular in front of a lateral process from the middle of each pectoral and subquadrangular behind them; hinder angles and margins rounded. Pectoral processes of about seven rays, blunt, length about equal that of snout or width of mouth. Scattered spines on the back, in two rows under the disk from below the pectoral extensions to near the snout; larger tubercles occur in a row above each orbit, on each shoulder (one or two), and in a vertebral series from the head to the first dorsal.

Ashy with spots of black, rounded to oblong in shape, small to large in size, to some extent arranged in transverse series and in about a dozen transverse bars between the back of the head and the first dorsal.

Total length of one specimen 29.4, length of disk 15.3, tail from vent 14.5, and greatest width 20.5 centimetres; of another the total length is 26.4, length of disk 14.3, tail from vent 12.9, and greatest width 17. centimetres.

Collected by the Albatross in about Lat. 30° N.; Long. 80° W., at depths of 270–258 fms.

Sympterygia.

Sympterygia Müller & Henle, 1837, Sitzb. akad. wiss. Berlin, p. 117.

Disk rhomboid, angled in front, rounded on the sides and behind. Pectorals extended forward of the skull, narrowly separated in the snout which includes a semicartilaginous rostral support. Mouth transverse, teeth small. Spiracles small, close to the eyes. Ventrals divided by a shallow notch. Tail depressed, with lateral folds, two dorsals and a rudimentary caudal. Nostrils with two valves; anterior reaching the mouth, joined to a wide isthmus; posterior tubular, as in Raia.

Sympterygia bonapartii.

Sympterygia bonapartii Müller & Henle, 1841, Plagios., p. 155, pl. 50, f. 1; Duméril, 1865, Elasm., p. 575; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 470.

Snout pointed, anterior margins almost straight, outer and hinder angles broadly rounded. From nostrils to tip of snout little more than their distance apart. Length of disk three fourths of the width. Nasal valves slightly fringed. Eyelid not produced. Teeth, of a female, flat. Slight asperities along the front edge of the disk, about the eyes, along the middle of the back, and on the tail. Of tubercles there is one in front of each eye, one between the eye and the spiracle, one between the dorsals, and a series from head to the first dorsal, interrupted above the abdomen. The lower surface is rough under the snout and the front ends of the pectorals.

Brown with spots of darker; below white, except the tail which is spotted with brownish.

Hab. ?

As figured by Müller and Henle the anterior margins form an angle of about 110°, the snout is little longer than the distance between the spiracles, and the ventral fins are much broader than long, features which readily distinguish *S. bonapartii* from *S. acuta*.

Sympterygia acuta.

Plate **27**, fig. 1–2; Plate **57**, fig. 1 (heart); Plate **68**, fig. 3–4 (skeleton).

Sympterygia acuta Garman, 1877, Proc. Bost. soc. nat. hist., **19**, p. 206.
Sympterygia bonapartii Berg, 1895, An. Mus. nac. Argent., ser. 2, **4**, p. 15; Evermann & Kendall, 1906, Proc. U. S. nat. mus., **31**, p. 72.

Disk rhomboid, length to end of pectorals about equal width, acute in front, rounded on lateral and hinder angles and margins. Pectorals extended far in front of the cranium, narrowly separated by the end of the snout, anterior margins slightly concave opposite the spiracles. Eyes small, spiracles little larger, distance apart two thirds of their distance from the margins of the disk. Mouth small, curved forward in the middle. Nostrils and narial valves as in Raia. Teeth small in $\frac{42-47}{40-45}$ rows, sharp in the middle of the mouth. Ventrals broad, with a rather shallow notch on the outer margin. Vent in middle of the total length. Tail depressed, with lateral folds, with two dorsal fins separated by an interspace and tubercles, and with a rudimentary caudal fin. Back, tail, and forward half of each pectoral rough with small spines; a row of broad-based hooked tubercles from head to dorsal fin. Total length 13.5, disk including ventral fins 9, snout to pores 8.5, and tail 5 inches.

Reddish brown, darker on the middle of the back and on the tail; white beneath.

Buenos Aires, secured by the Hassler Expedition.

Psammobatis.

Psammobatis Günth., 1870, Cat. fishes Brit. mus., **8**, p. 470.

Disk rounded, snout short, pectorals extending in front of skull, narrowly separated by the snout. Mouth transverse; teeth small. Spiracles small, close to the eyes. Ventrals deeply notched. Tail depressed, with lateral folds, two dorsals, and a rudimentary caudal. Back roughened with small spines and tubercles.

Southern South America.

Psammobatis scobina.

Raia scobina Philippi, 1857, Wiegm. arch., p. 270; 1892, An. Mus. nac. Zool., **1**, Chile, p. 2 extra, pl. 1, f. 1; Lönnberg, 1907, Hamb. magal. sammelreise, Fische, p. 7.
Uraptera scobina Duméril, 1865, Elasm., p. 574.
Psammobatis rudis Günth., 1870, Cat. fishes Brit. mus., **8**, p. 470; 1880, Challenger rept. Zool., **1**, p. 20, pl. 10; Lönnberg, 1907, Hamb. magal. sammelreise, Fische, p. 7.
Psammobatis rutrum Jordan, 1891, Proc. U. S. nat. mus., **13**, p. 334.
Psammobatis scobina Evermann & Kendall, 1906, Proc. U. S. nat. mus., **31**, p. 71.

Disk nearly round, anterior margins straighter, hinder margins and angles rounded. Snout slightly prominent. Eyes rather small. Spiracles nearly as large as the eyes. Mouth rather straight; teeth on the upper jaws in thirty-six rows on a specimen of about seven inches in length. Nostril with two valves, outer tubular. Vent near the middle of the total length. Ventrals rather large, deeply notched, partly covered by the pectorals. Upper surfaces covered with small sharp spines; larger tubercles in the median row and the lateral rows along the middle of the tail and back.

Brownish with a few spots of white and numerous small spots of brown, larger toward the middle and above the abdomen, forming transverse bars on the tail.

Total length $7\frac{1}{3}$, tail from vent $3\frac{2}{3}$, and width of disk 5 inches.

Sandy Point; Cape Virgins; Porto Bueno. 55 fathoms.

Psammobatis brevicaudatus.

Psammobatis brevicaudatus Cope, 1877, Proc. Amer. philos. soc., **17**, p. 32; Fowler, 1910, Proc. Acad. nat. sci. Phil., **62**, p. 471, fig. 2.

Disk broader than long, anterior, outer and hinder margins and angles broadly rounded; snout produced like a small papilla between the ends of the pectorals. Ventrals not very deeply notched. Width between orbits greater than length of orbit and spiracle. Top of head and a band along the anterior part of the disk, above and below, rough with minute spines; disk elsewhere smooth, excepting two spines in front of each orbit, a spine near the inner border of each spiracle, a row of a few spines near the edge of the disk opposite the eyes, a median row of six or eight on the middle of the back, a double row parallel to the edge of the pectoral and a median series on the tail. Tail much shorter than the body, one fifth longer than the claspers, with broad lateral folds, two dorsals, and a rudimentary caudal. Back plumbeous with darker shades; middle of anterior part of muzzle pale with a dark spot behind it. The measurements accompanying the description are probably incorrect. The total length is given as a little more than 12 inches (m. 0.307), the width nearly 10.6 (m. 0.270), and the length of the body to the vent about 7.48 (m. 0.190). The parallel rows of spines on the pectorals are the tenacula of the male.

Bay of Pacasmayo, Peru.

Malacorhina.

Malacorhina Garman, 1877, Proc. Bost. soc. nat. hist., **19**, p. 203.

Disk rhomboid, type with three rounded lobes. Pectorals extended in front of the cranium, where they are narrowly separated by the snout, which is slightly produced. No rostral cartilage in front of the skull. Mouth transverse, waved; teeth small, numerous. Ventral fins deeply notched; claspers of males tapering, pointed. Tail depressed, with lateral folds, two dorsals, and a rudimentary caudal. Closely allied to Raia and Psammobatis.

In the type movable cartilages above the proximal extremity of the hyomandibular, Plate **69**, fig. 1, *x*, with the spiracular, complete the foremost arch of eight arches, and prove that at one time in the early history of the mouth the upper jaws and the mentioned cartilages formed an arch with a suspensorium distinct from that of the lower jaws, in other words, that the mouth was formed of the anterior cleft of seven clefts five of which are now the gill openings. It indicates also that the presence of six gill clefts in certain Plátosomia, Pliotrema, is, as in different sharks, Hexeptranchidae and Chlamydoselachidae, an ancestral feature rather than an effect of specialization.

Malacorhina mira.

Plate **27**, fig. 3–5; Plate **69**, fig. 1–2 (skeleton).

Raia (*Malacorhina*) *mira* Garman, 1877, Proc. Bost. soc. nat. hist., **19**, p. 207.

Disk rhomboid, each anterior margin in two convex portions separated by a decided notch; or the disk may be described as somewhat trilobed, with an anterior and two lateral sections each broadly rounded. Snout produced, unsupported by a rostral cartilage. Mouth transverse, undulated, width nearly equal length of snout; teeth sharp in the median series, in $\frac{37}{38}$ rows. Eyes moderate, prominent, lids curved outward. Spiracles larger than the eyes. Anterior portion of ventrals smaller, narrow; claspers strong in the base, tapering, pointed. Disk with scattered small scales, larger opposite the eyes. Narrow, hooked tubercles in an irregular vertebral series, behind the head and on the tail, interrupted above the abdomen, smaller ones at each side of the median; tail rough. Male with several elongate rows of erectile hooks near the outer edge of each pectoral. Nostrils farther from one another than from the edges of the disk; valves as in Raia. Dorsal fins near the end of the tail separated by a short space.

Rusty brown above; whitish below. Secured by the Hassler Expedition at Mejillones, Chile.

Dasybatidae.

Body head and pectorals depressed, together forming a broad disk, in which the pectorals meet in front of the cranium forming the snout without a supporting rostral cartilage. Spiracles large close behind the eyes. Anterior nasal valves confluent across a narrow isthmus, reaching the mouth. Mouth transverse, more or less curved. Teeth small, in quincunx, tessellated. Gill openings narrow. Anterior copula of hypobranchial cartilages segmented. Ventrals small, below the pectorals. Tail distinct from the disk, narrow, tapering, with a serrated spine in all the genera except Rhachinotus. Skin smooth or rough with spines or tubercles or both.

Tail long whip-like, without a serrated spine
  disk circular . . . . . *Rhachinotus* (page 373)
Tail long whip-like, with a serrated spine
  prepelvic process absent or rudimentary
    disk quadrangular; tail filamentary . *Dasybatus* (page 375)
    disk oval; tail compressed . . . . *Taeniura* (page 398)
Tail moderate to short, with a serrated spine
  dorsal fin absent
    disk circular; caudal fins rayed, tail blunt . *Urobatis* (page 401)
    disk circular; caudal fins rayed, tail pointed . *Urotrygon* (page 404)
    disk subquadrangular, tail short . . . *Urolophus* (page 407)
  dorsal fin present
    disk of moderate breadth; tail short with rayed caudal fins
      Trygonoptera (page 409)
    disk very broad; tail tapering, pointed . . *Aëtoplatea* (page 411)
  dorsal fin absent
    disk very broad; tail short, slender, pointed . *Pteroplatea* (page 412)

Rhachinotus.

Gymnura Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117.
Urogymnus Müller & Henle, 1837, Wiegm. arch., p. 400; 1838, Charlesworth's mag., **2**, p. 90; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 471.
Anacanthus Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117; 1838, Charlesworth's mag., **2**, p. 90; 1841, Plagios., p. 156.
Rhachinotus T. Cantor, 1849, Malay fishes, p. 422.

Disciform, subcircular; pectorals meeting in front. No rostral cartilage. Mouth transverse, waved. Teeth tessellated, flattened, rhomboid. Spiracles large, close behind the eyes. Scales tubercular, with broad rounded to polygonal bases, varying in shapes, sizes, and numbers with age. Head rather prominent. No dorsal fin. Margins and angles of pectorals rounded. Ventrals short, broad. Tail long, slender, tapering, without a spine or fins other than a narrow cutaneous subcaudal at some stages.

Rhachinotus africanus.

Raia africana Schneider, 1801, Bloch Ichth., p. 367, no. 23.
Raia asperrima Schneider, 1801, Bloch Ichth., p. 367, no. 24.
Gymnura asperrima Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117.
Urogymnus asperrimus Müller & Henle, 1837, Wiegm. arch., p. 437; 1838, Charlesworth's mag., **2**, p. 90; Duméril, 1865, Elasm., p. 580; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 571; Klunzinger, 1871, Syn. fische, **2**, p. 244; Day, 1878, Ind. fishes, p. 736, pl. 195, f. 1; Annandale, 1909, Mem. Ind. mus., **2**, p. 37, pl. 3, f. 8, pl. 7, f. 2.
Anacanthus africanus Müller & Henle, 1841, Plagios., p. 157, no. 1.
Anacanthus asperrimus Müller & Henle, 1841, Plagios., p. 157, no. 2, pl. 60, f. 5–7.
Rhachinotus africanus T. Cantor, 1849, Malay. fishes, p. 422; Bleeker, 1853, Nat. tijds. Ned. Ind., **4**, p. 514.
Urogymnus africanus Duméril, 1865, Elasm., p. 581.
Urogymnus rhombeus Klunzinger, 1871, Syn. fische, **2**, p. 243.
Urogymnus laevior Annandale, 1909, Mem. Ind. mus., **2**, p. 37.

Disk suboval, more pointed backward, with a slight prominence at end of snout. Anterior nasal valves confluent, fringed posteriorly. Mouth waved, palatal velum fringed, three to five papillae at the bottom. Teeth blunt, broader than long, in about forty-eight rows on the jaw of a specimen over twenty inches in length of body. Scales tubercular, unequal, more or less striated, with rounded bases where not in contact, with polygonal bases where crowded and with cusps short to long, acute, blunt, or rounded to depressed and shovel-shaped. One specimen shows that the cusps over body, head, and basal portion of tail, are irregularly of two forms; one short depressed shovel- or horse-shoe shaped with an excavation toward the base, the other, on the larger tubercles, more conical and erect. In a wide area around the edge of the disk, where the scales are not in contact, only the latter appear. The depressed cusps are directed from either side toward the median line of the back; as the line is approached they turn more backward. Ventrals well covered by the pectorals. Tail nearly twice the length of the body, with or without a narrow fold below according to age.

Yellowish to whitish on the tubercles; skin dark brown where exposed.

Indian Ocean; East Indies.

Dasybatus.

Dasybatus Klein, 1742, Hist. pisc. miss., **3**, p. 34; 1775, Neuer schaupl., **1**, p. 991; Walbaum, 1792, Art. gen. pisc., p. 581.
Trygonobatus Blainv., 1816, Bull. Soc. philom.
Trygon Cuv., 1817, Reg. anim., **2**, p. 136; Müller & Henle, 1837.
Himantura Müller & Henle, 1837.
Hypolophus Müller & Henle, 1837.

Disk subquadrangular to subcircular, smooth or with spines and tubercles. No rayed dorsal fins. Pectorals meeting in front of the skull. No rostral cartilage supporting the snout. Anterior copula of branchihyal cartilages segmented. Tail elongate, whip-like, with a serrated caudal spine, with or without dermal fin-folds or keels behind the spine, and without lateral folds on the base. Pelvis without a prepelvic process.

For convenience the species of this genus may be arranged by means of the cutaneous folds on the tail in four more or less distinct groups.

Tail without keels or folds
Type *D. uarnak* . . . . . *Himanturus* (page 375)
Tail without a keel above, with a fold below
Type *D. sephen* . . . . . *Pastinachus* (page 381)
Tail with a keel above and a fold below
Type *D. pastinacus* . . . . . *Dasybatus* (page 388)
Tail with folds both above and below
Type *D. sabinus* . . . . . *Amphotistius* (page 392)

Himanturus.

Cutaneous folds or keels on the tail none
disk broader than long; tubercles depressed, in pavement
tail thrice the length of body, or more; papillae 4–7;
brown with dark spots, tail banded . . *uarnak* (page 376)
tail twice length of body, or more; papillae 2
brown with yellow reticulations . . . *favus* (page 377)
tail three times length of body, or more; papillae 4
brown with lighter spots, tail banded . *gerrardi* (page 377)
tail twice length of body, or more; papillae 4
brown with paler spots; snout pointed . . *alcocki* (page 378)
tail once length of body, or more; tubercles rounded
olive, tail grey; snout pointed; papillae 4 *jenkinsii* (page 378)

tail once length of body, and more; papillae 2
gray with blackish margins; snout blunt *marginatus* (page 378)
tail thrice length of body, or more; papillae 2
brown, tail without bands; tubercles depressed *bleekeri* (page 379)
tail one and one half times length of body; papillae 2
reddish brown, yellow spotted; width and length nearly equal
imbricatus (page 379)
tail one and one half times the body; papillae 4; colors uniform
ponapensis (page 380)
tail longer than body; tubercles with stellate bases
white, tail gray to brown; papillae 5 . . *microps* (page 381)

Dasybatus uarnak.

Raia uarnak Forskål, 1775, Descript. Anim., p. viii, ix, 18.
Raia uarnak Gmelin, 1789, Linné Syst., **1**, p. 1509.
Trygon uarnac Cuv., 1817, Reg. anim., **2**, p. 136.
Trygon russellii Gray & Hardwicke, 1834, Ill. Ind. zool., **2**, pl. 100.
Pastinachus uarnak Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 69, pl. 19, f. 2–2b.
Trygon uarnak Müller & Henle, 1841, Plagios., p. 158; T. Cantor, 1849, Malay. fishes, p. 423; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 69; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 44; Duméril, 1865, Elasm., p. 585; Day, 1865, Fishes Malabar, p. 277; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 473; Day, 1878, Ind. fishes, p. 737; Annandale, 1909, Mem. Ind. mus., **2**, p. 22, fig. 2, pl. 1, f. 1, 2, pl. 2, f. 1–1a, pl. 3, f. 2; Günther, 1910, Südsee fische **3**, p. 492.
Trygon variegatus McClelland, 1841, Calcutta journ. nat. hist., **1**, p. 60, pl. 2, f. 2; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 43; Duméril, 1865, Elasm., p. 587.
Trygon undulata Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 70; Duméril, 1865, Elasm., p. 586.
Trygon pareh Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 71; Duméril, 1865, Elasm., p. 590.
Trygon uarnacoides Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 72; Nat. tijds. Ned. Ind., **3**, p. 738; Duméril, 1865, Elasm., p. 586.
Trygon pastinacoides Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 75.
Trygon ellioti Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 41.
Trygon punctata Günth., 1870, Cat. fishes Brit. mus., **8**, p. 474.
Trygon (Himantura) oxyrhynchus Sauvage, 1878, Bull. Soc. philom., p. 91.

Disk rhomboid, broader than long, anterior margins nearly straight, meeting in a very blunt angle, snout little produced, outer angles rounded, outer margin somewhat convex, hinder angles broad, blunt. Mouth waved, curves in the bands of teeth abrupt; six to seven papillae at the bottom, a small median papilla occurring between the two large ones in front. Eyes prominent. Spiracles larger than the eyes. Ventrals oblique on the hind margin, anterior rays much the longer, outer angle very blunt. Tail slender, more than three times the length of the body, without keels or folds. Skin smooth on very young. The specimen measured below has two depressed median tubercles above the shoulder girdle and groups of smaller ones in front of them and behind

them. On larger specimens the tubercles spread over head, trunk, and tail, but the vertebral series apparently does not extend upon the tail. Snout to abdominal pores 9, from pores to end of tail 31, and greatest width 10 inches.

Disk brown thickly marked by small spots of darker, smaller on the head. Tail with oblong spots of brown which backward become narrow transverse bands separated by equal spaces of whitish. With age the spots are lost and the skin becomes a uniform greyish brown.

Indian Ocean; Red Sea; East Indies.

Dasybatus favus.

Trygon favus Annandale, 1909, Mem. Ind. mus., **2**, p. 25, pl. 1, f. 3, pl. 3, f. 10.

Disk flat, pectorals even more broadly rounded than in *D. uarnak;* snout somewhat more produced, its length five seventeenths of the length of the disk. Eyes small, widely separated. Mouth waved, with two papillae. Tail rather less than twice the length of the disk. No stellate based denticles.

Dark brown with reticulations of dull yellow, a yellow spot or streak in the middle of snout meshes; lower surface white. Known from the description and figure, from a female 130 cm. in width; apparently a variety of *D. uarnak.*

Off coast of Orissa.

Dasybatus gerrardi.

Trygon gerrardi Gray, 1851, Chondropterygii, p. 116; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 474; Annandale, 1909, Mem. Ind. mus., **2**, p. 24, pl. 2, f. 2, pl. 3, f. 6.
Trygon macrurus Bleek., 1852, Verh. Bat. gen., **24**, Plagios., p. 74; Nat. tijds. Ned. Ind., **3**, p. 607.
Trygon liocephalus Klunzinger, 1871, Syn. fische, p. 238.
Trygon uarnak Day, 1878, Ind. fishes, pl. 194, f. 1.
Trygon granulata Macleay, 1883, Proc. Linn. soc. N. S. W., **7**, p. 598.
Himantura fai Jord. & Seale, 1906, Bull. U. S. fish comm., **25**, p. 184, fig. 2.

Disk broader than long, subquadrangular, anterior margins slightly waved, meeting in an obtuse angle; outer margin convex; outer and hinder angles rounded. Mouth undulated, with four papillae; teeth with a transverse ridge on the crown. Skin smooth in young; older ones with one or more tubercles on the middle of the back and from these a somewhat irregular series of smaller tubercles extends backward and forward. Large specimens have close-set spines, in pavement, on head and trunk and extending back upon the tail in front of the caudal spine. Tail slender, about three times the length of the body, without keels or folds, roughened on old individuals.

Uniform brownish in young; older with scattered spots of yellowish on the posterior part of the disk and with narrowed yellowish cross-bands on the tail; very old ones greyish brown. A very close ally, possibly a variety, of *D. uarnak*.

India; East Indies; Samoa; Zanzibar.

Dasybatus alcockii.

Trygon alcockii Annandale, 1909, Mem. Ind. mus., **2**, p. 27, f. 3.

Disk broader than long; snout pointed, its length two ninths of that of the disk, greater than the width between the orbits. Mouth small, waved, with four papillae at the bottom. Skin tough; scales flat, more or less rounded. Tail slightly depressed, not twice as long as the disk, without cutaneous folds, with a serrated spine.

Dark olive-brown, with small obscure paler spots scattered over the disk and base of the tail; edges of fins purplish; beneath whitish. Off the coast of Orissa, India.

Apparently a variety of *D. uarnak*.

Dasybatus jenkinsii.

Trygon jenkinsii Annandale, 1909, Mem. Ind. mus., **2**, p. 28, f. 4.

Disk broader than long, outer angles rounded; snout pointed, length two sevenths to one fourth of that of the disk. Mouth undulated with four papillae. Head, middle of back, and top of tail with a pavement of small flat rounded scales, bluntly spinous on the tail. Enlarged spines with depressed crowns in irregular series above the vertebrae. Tail not much longer than the disk, without cutaneous folds, with a serrated spine.

Back reddish olive, without definite markings; tail greyish; lower surfaces white.

The type, a male, from which the description was taken measured 103.75 cm. across the disk; it was caught off the Ganjam Coast, India.

Probably a variety of *D. uarnak*.

Dasybatus marginatus.

Trygon marginatus Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 38; Day, 1878, Ind. fishes, p. 738; Annandale, 1909, Mem. Ind. mus., **2**, p. 30, f. 5, pl. 3, f. 11.

Disk broader than long, outer angles narrowly rounded, snout blunt. Eyes small. Mouth rather small, waved, with two papillae, near the angles. Head and middle of back with closely set rounded depressed denticles more or less

mixed with stellate spines, especially on the tail. Tail much longer than the disk, without cutaneous folds, with a serrated spine.

Back grey, with a blackish tint, male with bluish streaks near the margins, tail blackish; white below with a more or less distinct broad blackish margin along the outer and the hinder edges.

Burma; Ganjam; India.

Dasybatus bleekeri.

Trygon bleekeri Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 41; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 475; Day, 1878, Ind. fishes, p. 738, pl. 195, f. 3; 1889, Fauna Brit. Ind., **1**, p. 54; Annandale, 1909, Mem. Ind. mus., **2**, p. 26, pl. 3, f. 9.

Disk little broader than long; snout produced, narrow, acute, its length one third of that of the disk or twice the distance between the eyes. Mouth strongly waved, with two papillae near the middle on the bottom. Scales in pavement from head to base of tail over the middle of the body, with depressed crowns and rounded bases; intermixed larger and smaller tubercles appear above the abdominal region and on the back and the sides of the tail to the spine. A large round tubercle on the middle of the back is surrounded by smaller ones. Tail three or more times the length of the disk, rough to its end.

Back dark brown, unspotted; tail without light rings; ventral surface white, with a broad margin of dark brown which widens with age until the white nearly or quite disappears, or is blotched and clouded with brown.

Apparently one of the numerous varieties of *D. uarnak*.

Burma; Orissa; Bengal.

Dasybatus imbricatus.

Raia imbricata Schneider, 1801, Bloch Ichth., p. 366.
Isacurrah tenkee Russell, 1803, Coromandel fishes, **1**, p. 3, pl. 4.
Tenkee shindraki Russell, 1803, Coromandel fishes, **1**, p. 3, pl. 5.
Trygon imbricata Cuv., 1817, Reg. anim., **2**, p. 136; Müller & Henle, 1841, Plagios., p. 164; T. Cantor, 1849, Malay. fishes, p. 425; Duméril, 1865, Elasm., p. 606; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 481; Day, 1878, Ind. fishes, p. 739; Annandale, 1909, Mem. Ind. mus., **2**, p. 32, pl. 3, f. 5.
Pastinaca brevicauda Swains., 1839, Class., **2**, p. 319.
Pastinaca dorsalis Swains., 1839, Class., **2**, p. 319.
Trygon walga Müller & Henle, 1841, Plagios., p. 159, pl. 51, f. 1; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 67; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 591; Duméril, 1865, Elasm., p. 589; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 475; Day, 1878, Ind. fishes, p. 738, pl. 194, f. 3.
Trygon heterurus Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 67; Duméril, 1865, Elasm., p. 591.
Trygon polylepis Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 73; Duméril, 1865, Elasm., p. 590; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 475.
Trygon dadong Bleeker, 1856, Nat. tijds. Ned. Ind., **10**, p. 355; Duméril, 1865, Elasm., p. 591.
Trygon nuda Günth., 1870, Cat. fishes Brit. mus., **8**, p. 476.
Leiobatis (*Trygon*) *nuda* Bleeker, 1879, Verh. Kong. akad., **18**, Enum., p. 33.

Disk subcircular, about as broad as long, anterior margins slightly concave opposite the eyes, outer margins and outer and hinder angles broadly rounded; snout produced, sharp, length more than twice the interorbital width. Mouth waved, curves rather abrupt, with two papillae at the bottom; teeth in 42 rows, with a transverse ridge; spiracles as large as the eye. Ventrals subtriangular, hinder rays shorter. Young, and rarely occasional adults, smooth. Older individuals with top of head and back of trunk covered with minute scales, either uniform or with larger ones in a vertebral series of rounded or depressed tubercles. This species is very variable, it may be with or without larger scales irregularly placed in the vertebral series, or with or without a larger scale or group of several at each side of the vertebral series above the shoulder girdle. Most specimens have a median series of large depressed tubercles on the base of the tail in front of the caudal spine, but these may be absent or may vary in number from one to seven. The scales of the back vary from uniform close-set to comparatively few and scattered, or absent. In a large number of specimens from Penang the females are a trifle the larger and the adults among them have a peculiar shortened and swollen end of the tail behind the spine. Generally the filamentary extremity appears to be lost but sometimes a young female is found in which the swelling is well advanced while the thin extremity is retained. Very young females are like the males. The tail is about one and one half times the length of the body, varying to longer or shorter; it is without folds or rarely is with rudimentary ridges (possible effects of contraction in preservation).

East Indies.

Dasybatus ponapensis.

Trygon ponapensis Günther, 1910, Südsee fische, **3**, p. 493, pl. 180.

Disk subcircular or oval, nearly as broad as long. Snout moderate, with slight prominence. Head rather large; eyes prominent. Four tentacles on the floor of the mouth. Mouth waved. Tail strong in the base, tapering, little more than one and one half times the length of the disk, without dermal folds. Skin smooth. Color uniform. Evidently a very young individual.

Günther says this form is very near his *T. nuda*, but differs in the oral outline of the disk and lack of prominence at the tip of the snout. *T. nuda* (*imbricatus*) has only two tentacles at the bottom of the mouth.

Ponapé.

Dasybatus microps.

Trygon microps Annandale, 1908, Rec. Ind. mus., **2**, p. 393, pl. 27; 1909, Mem. Ind. mus., **2**, p. 26, fig. 1, pl. 2, f. 3, pl. 4, f. 1.

Disk rhombic wider than long, outer angles greater than 90°. Snout rounded, tip of slight prominence. Eyes very small. Spiracles large, eight times the ocular area. Mouth large, waved, with five papillae. Teeth with a transverse ridge. Disk with numerous minute stellate-based spines, little larger on the tip of the snout and around the eyes and the spiracles, in cases extending to the lower edges of the pectorals. Base of tail with larger spines on the sides, small ones beneath and posteriorly. Tail probably much longer than the body, without fin folds, with a serrated spine, basal portion broad and flat, the distal portion slender and round.

Disk white without definite markings; tail grey above, darker backward.

Known from the description of two specimens, 190 to 222 cm. in width.

Bay of Bengal.

Pastinachus.

A cutaneous fold below the tail, none above
- disk broader than long; tubercles rounded, stellate
  - tail more than twice length of body; buccal papillae 5
    - brown, uniform or blotched with lighter and darker — *marinus* (page 382)
  - tail more than twice length of body; buccal papillae 5
    - brown, uniform or irregularly spotted; tubercles compressed — *latus* (page 383)
  - tail thrice length of body; scales tessellate; papillae 5
    - brown; snout sharp . . . . *bennetti* (page 383)
  - tail one and one half lengths of body; angles of disk distinct
    - brown, uniform . . . . . *rudis* (page 384)
  - tail nearly thrice length of disk; tubercles depressed, pointed
    - brown, tail blackish; teeth unequal; papillae 5 — *sephen* (page 384)
  - tail about once length of disk; spines stellate; papillae 3
    - slaty grey, spotted with white . . *brevicaudatus* (page 385)
  - tail two and one half lengths of disk; disk hardly as broad as long
    - brown; buccal papillae 3; a large round tubercle on the back — *margarita* (page 386)

tail twice length of disk; disk rounded, little wider than long
tubercles one on each shoulder . . *schmardae* (page 386)
tail one and a half lengths of disk; disk wide, angles rounded.
tubercles a group on each shoulder; squamae like shagreen of sharks . . . . . *torrei* (page 386)

Dasybatus marinus.

Plate **33**, fig. 1–2; Plate **44**, fig. 7 (brain); Plate **53**, fig. 5 (pelvis).

Pastinaca aspera Belon, 1553, Aquat., p. 94; Willughby, 1686, Pisc., p. 68, pl. D5, f. 3; Moreau, 1891, Poiss. France Suppl., p. 12.
Pastinaca marina Columna, 1592, Phytob., ed. 1744, p. 105, pl. 28.
Dasybatus marinus Klein, 1742, Hist. pisc. miss., **3**, p. 35; 1775, Neuer schaupl., **1**, p. 992.
Raia centroura Mitch., 1815, N. Y. lit. & philos. trans., **1**, p. 479; DeKay, 1842, N. Y. fish., p. 373 note.
Trygon aspera Cuv., 1817, Reg. anim., **2**, p. 36.
Trygon gesneri Cuv., 1829, Reg. anim., **2**, 400.
Trygon thalassia Müller & Henle, 1841, Plagios., p. 161; Gray, 1851, Chondropterygii, p. 118; Duméril, 1865, Elasm., p. 596; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 477; Hector, 1872, Fishes of New Zealand, p. 85; Canestrini, 1872, Ital. pesci, p. 59; Doderlein, 1885, Man. ittiol. Medit., **3**, p. 228.
Trigon centroura Linsley, 1844, Amer. journ. sci., **47**, p. 78.
Pastinaca acanthura Gray, 1854, Gron. syst., p. 12.
Trygon ukpam Smith, 1859, Proc. Roy. soc. Edinb., p. 64; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 480.
Pastinaca hastata Storer, 1867, Mass. fishes, p. 268, pl. 39, f. 3.
Dasyatis centrurus Jord. & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 47; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 83.
Dasibatis centrura Garman, 1882, Bull. 16, U. S. nat. mus., p. 67.

Disk subquadrangular, about one fourth wider than long, anterior margins forming a blunt angle at the end of the snout, posterior margins nearly straight, hinder angles blunt. Mouth arched forward, with five papillae. Teeth blunt, smooth, in quincunx, in rows, in a specimen $43\frac{1}{2}$ inches in width.

Ventrals truncate, angles rounded. Tail more than twice as long as the disk, compressed distally, rounded above, with a dermal fold below from the base of the spine backward, rough on all sides with broad based stellate to round tubercles each with a sharp conical cusp. Young individuals smooth; as they grow scattered tubercles appear on the middle and hind part of the back and on the top and sides of the tail; very old ones have the middle of the back and the top and sides of the tail closely mailed with small flattened tubercles among which are the larger ones. Readily distinguished from its nearest allies in the Atlantic by the tubercles and the absence of a supracaudal fold.

Atlantic and the Mediterranean Sea.

Dasybatus latus.

Plate **32**, fig. 1-2.

Trygon lata Garman, 1880, Bull. M. C. Z., **6**, p. 170.
Dasibatis lata Garman, 1882, Bull. 16, U. S. nat. mus., p. 67.
Dasyatis thetidis Waite, 1899, Mem. Austr. mus., **4**, p. 46.
Dasyatis sciera Jenkins, 1904, Bull. U. S. fish. comm., **22**, p. 421, pl. 1, f. 2; Jord. & Everm., 1905, Bull. U. S. fish comm., **23**, p. 47, pl. 4, f. 2.
Dasyatis lata Jord. & Everm., 1905, Bull. U. S. fish. comm., **23**, p. 47.
Trygon lata Günther, 1910, Südsee fische, p. 493.

Disk subquadrangular, one fourth wider than long, very blunt angled at the end of the snout which is produced in a rounded prominence. A line crossing the widest portion of the disk passes nearer to the head than to the shoulders. Mouth somewhat curved, with six (5–6) papillae. Ventrals short, subtruncate.

Tail more than twice the length of the body, without fold or keel above, with a long narrow fold below, terminating in a keel extending to the end, with top and sides armed with small tubercles and an irregular series of broad-based tubercles along each side. A pair of large erect compressed tubercles in front of the caudal spine, a single tubercle above the middle of the pelvic arch, three larger, elongated tubercles the points of which extend backward above the middle of the shoulder girdle. Differs from *D. marinus* in the prominent snout, in narrowness of hinder part of disk and in shape of the vertebral tubercles.

Length of body 16, of tail 35.3, and width of disk 20.5 inches.

Light olive-brown on the back; white beneath.

Collected by Andrew Garrett at the Hawaiian Islands.

Dasybatus bennetti.

Trygon bennetti Müller & Henle, 1841, Plagios., p. 160, pl. 53; Duméril, 1865, Elasm. 595; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 480.
Trygon carnea Richardson, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 197.

Disk subrhomboid, nearly as broad as long, anterior margins nearly straight, until near the tip of the snout which is produced in an angle of less than 90°, outer angles and hind margins broadly rounded, hinder angles more narrowly rounded, mouth waved; teeth of male flat. Eyes and spiracles moderate. Tail three times as long as the body, with a serrated spine at the end of the anterior sixth of its length, and with a narrow fold below of less than one sixth of the caudal length. Skin smooth in young, on large individuals rough with a pavement of scales and tubercles on the middle of back and tail. Spines less closely set

behind the caudal spine. Resembles *D. sabinus* in shape but is distinguished by length of tail and by armature. A tubercle in the middle of the back becomes gradually surrounded by others, thence they extend backward to the caudal spine.

Coloration uniform.

China: India.

Dasybatus rudis.

Trygon rudis Günth., 1870, Cat. fishes Brit. mus., **8**, p. 479.

Disk broader than long, with very distinct outer angles. Snout somewhat pointed; anterior margins concave. Back and tail rough with dense small asperities, rather larger and stellate-based on the middle of the tail; no larger tubercles. Tail one half longer than the disk, without a keel above, with a fold below.

Uniform brown.

Old Calabar.

Dasybatus sephen.

Raia sephen Forskäl, 1775, Descript. Anim., p. 17, no. 16; Bonnaterre, 1778, Ichth., p. 4; Gmelin, 1789, Linné Syst., **1**, p. 1508; Lacépède, 1798, Poissons, **1**, p. 123; Schneider, 1801, Bloch Ichth., p. 364; Shaw, 1804, Zool., **5**, p. 288.

Raia sp. Russell, 1803, Coromandel fishes, **1**, p. 2, no. 2, pl. 3.

Trygon sephen Cuv., 1817, Reg. anim., **2**, p. 137; Peters, 1876, Sitzb. Berl. akad., p. 853; Günther, 1910, Südsee fische, p. 494.

Trigon (Pastinachus) sephen Rüppell, 1828, Atlas fische, p. 52; 1835, Neue wirb. Abyssinien, Fische, p. 69.

Trigon forskälii Rüppell, 1828, Atlas fische, p. 53, pl. 13, f. 2.

Trygon wolga-tenkee Cuv., 1829, Reg. anim., **2**, p. 399.

Hypolophus sephen Müller & Henle, 1841, Plagios., p. 170; T. Cantor, 1849, Malay fishes, p. 429; Gray, 1851, Chondropterygii, p. 123; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 77; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 37; Duméril, 1865, Elasm., p. 616; Day, 1865, Fishes Malabar, p. 279.

Trygon (Hypolophus) sephen Günth., 1870, Cat. fishes Brit. mus., **8**, p. 482; Klunzinger, 1871, Syn. fische, **2**, p. 240; Day, 1878, Ind. fishes, p. 740, pl. 195, f. 2.

Disk subquadrangular, much broader than long, angles obtuse, snout blunt, margins slightly convex. Mouth strongly undulate, upper dental lamina angularly bent forward, the upper jaws meeting in a sharp angle at the symphysis; lower dental plate more flat, nearly three fourths as long as wide; teeth unequal, largest wider than long. Five long papillae at the bottom of the mouth, middle three elongate and close together. Anterior nasal valves joined and free edged behind the isthmus in front of the mouth. Eyes prominent. Spiracles larger than the eyes. Ventrals short, broad, oblique on the hind margin, angles blunt. Tail nearly three times the length of the disk, depressed and rather stout anteriorly, slender and filamentary behind the spine; with a long

deep fold below, beginning in front of the spine and ending at the posterior third of the length; without fold or keel above. A row of several, 1–5 or more, depressed, five-pointed, or subcordate, tubercles on the middle of the back and around these a pavement of depressed scales with flattish or concave five-pointed crowns, this pavement extending over head, trunk and base of tail, a less or greater distance toward margins or spine according to age. Very young smoother; lower surfaces and outer edges of disk smooth.

The specimen described, brought from southern Celebes by Dr. Thomas Barbour, measured from body to abdominal pores $9\frac{1}{2}$; pores to end of tail 26, and in greatest width $11\frac{3}{4}$ inches.

Back olivaceous brown, rusty toward edges of pectorals; white below; tail blackish behind the spine, edge of fold black.

Indian Ocean; Red Sea; East Indies; India.

Dasybatus brevicaudatus.

Trygon thalassia Hutton, 1872, Cat. p. 85.
Trygon brevicaudata Hutton, 1875, Ann. mag. nat. hist., ser. 4, **16**, p. 317; 1876, Trans. N. Z. inst., **8**, p. 216.
Dasybatis brevicaudatus Hutton, 1904, Index fauna N. Z., p. 53; Waite, 1909, Rec. Canterb. mus., **1**, no. 2, p. 21, pl. 22.

"Disk broader than long, anterior margins forming a very obtuse angle which is interrupted by a short projection of the snout. Body smooth with a single small oval tubercle in the centre of the back. Tail not longer than the body, with a cutaneous fold along the lower side, but no upper ridge, armed with two serrated spines, the anterior one the smaller, and in front of these a row of large ossifications; sides of the tail with smaller stellate ossifications. Brown above, whitish below. Length of disk 44 inches, breadth 48: tail 32+ inches. Dunedin Harbour. The end of the tail of this specimen is broken off; but it is evident that it could only have extended a few inches further."

Waite adds to this description:— Mouth with three papillae. Teeth in twenty-five rows; each tooth with a shallow transverse excavation. Slaty grey above; an irregular series of white spots along each side between midline and margins in the thoracic region, and two white spots on each side above the abdomen. The length of disk is given as 800 mm. and the width 780 mm.

New Zealand.

Dasybatus margarita.

Trygon margarita Günth., 1870, Cat. fishes Brit. mus., **8**, p. 479; Steindachner, 1894, Notes Leyden mus., **16**, p. 91.

Disk subround, scarcely longer than broad, anterior margins forming an obtuse angle beyond which the tip is produced in a short point, outer angles and margins broadly rounded. Mouth with three long papillae and two short ones. Skin smooth; a large round tubercle in the middle of the back, and in cases traces of a second in front of the large one. Tail two and a half times the length of the disk, with a dermal fold below, none above. In the young according to the original description the disk was $8\frac{1}{2}$ inches long, the tail 19.

Brown above; white below.

West Africa.

Dasybatus schmardae.

Trygon schmardae Werner, 1904, Zool. jahrb., **21**, p. 298.

"Nahe verwandt mit *Trygon hystrix* M. & H., aber durch folgende Merkmale unterscheidbar: Scheibe vorn nicht vollkommen abgerundet, sondern mit kleinem Schnautzenzipfel. Oberseite vollständig rauh, auch die Brustflossen, wenngleich spärlicher als der Rumpf. Schwanz ohne vergrösserte Dornen. Scapulargegend mit 2 grossen, runden, Strahlig gerippten Tuberkeln nebeneinander (Entfernung wie die der Nasenlöcher). Schwanz fast doppelt so lang wie die Schiebe. Färbung gleichförmig braun, Schwanz dunkler.

Länge der Scheibe 24, Breite 26, Schwanzlänge 47 cm.; Entfernung der Nasenlöcher $2\frac{1}{2}$, der Augen $4\frac{1}{2}$, der Nasenlöcher von der Schnauzenspitze 4 cm.

1 Exemplar (♀) aus Jamaica."

Dasybatus torrei, sp. nov.

Trygon species dubia.— *Lebisa* 319, Poey, 1868, Synops. pisc. Cub.; Repert. fis.-nat. Cuba, **2**, p. 457.
Raja?....— *Lebisa.*— Num. 316, Poey, 1876, Enum. pisc. Cub., p. 205; An. Soc. Esp. hist. nat., **5**.

"Lebisa" of the Cubans is intermediate in shape between the circular of the Potamotrygones (Plate **31**) and the polygonal of most Dasybati (Plate **32**), but is nearer the latter. The rostral section is short and is so broadly rounded in front of the head that the forward margin of the disk is nearly straight for some distance. Toward the sides near the widest part the curves become more abrupt; in about two thirds of the length (behind the spiracles) the disk narrows rapidly toward the ventral fins. There are no angles either at the sides or in front; a papilla marks the median line of the snout. The greatest width is a short

distance behind the head. Eyes very small. Mouth small; cleft waved; lower jaws prominent at and near the symphysis; upper jaws indented at the symphysis, with a prominence farther out at each side. Teeth small, in quincunx as in other Dasybati, larger on the prominences of the upper jaws. The inner edge of the crown, that toward the throat, of each tooth is longer, a semicircle, and, on the male, has a sharp point on the middle; the crown is rough and is crossed by a transverse groove in front of a prominent rugose ridge and behind another of less prominence and length. The sharp point on the hind edge of the tooth is probably a feature of the males as they become mature. Spiracles large. Scales on body and tail small, closely set, farther apart and decreasing in size to minute near the edges of the disk and on the sides of the tail. On the middle of the top of each scale there is an apex from which ridges, commonly four, radiate dichotomizing distally. A group of several small tubercles, enlarged scales, appears at each side of the vertebral column on the shoulder girdle, the groups separated from one another by about two fifths of the distance between the spiracles. No other tubercles on body or tail. Entire lower surfaces and tops of ventral fins smooth. Tail about one and one half times as long as the disk, strong anteriorly, becoming quite slender behind the serrated spine, or spines, rounded on the top, as in *D. marinus*, that is, without a trace of a dermal fold, with a low fin fold on the lower side, below the spine and about twice its length.

Olivaceous brown, darker above the margins; tops of ventrals rusty brown.

Length of body about 19 inches; length of tail 29; greatest width $21\frac{1}{4}$, at $7\frac{1}{2}$ inches from end of snout; nostrils to end of snout $2\frac{3}{4}$, their distance apart about $1\frac{1}{2}$; vent to serrated spine $12\frac{1}{2}$; distance between groups of tubercles on the shoulder girdle $1\frac{1}{8}$; diameter of eye $\frac{1}{4}$ inches.

Specimen described a young male from Tunas de Zaza, Cuba received from Dr. Carlos de la Torre y Huerta.

This sting-ray is placed between the typical Dasybati and the Potamotrygones. It differs from the latter in lacking enlarged tubercles on the vertebral line and in lack of a keel-like compression on the top of the tail. Its scales also differ from those of *P. hystrix* and other Potamotrygones in that on those species the ridges of the crowns do not dichotomize outward but the increase in the numbers of ridges is made by other ridges that rise independently between the primary ridges. On the scales of *Dasybatus torrei* each ridge divides into two and each of these again divides into two and so on. Most likely Lebisa is somewhat allied to *D. schmardae* described by Werner from Jamaica. Both species are no doubt without the cartilaginous prepelvic spine so characteristic of the river

Trygons. The few particulars given in Werner's original description hardly favor a close comparison. Both are placed in the subgenus Pastinachus. Werner's type is said to be nearly related to *P. hystrix*, to be not entirely rounded in front but to have a small rostral projection, and to have a tail nearly twice the length of the body. *D. torrei* is shaped posteriorly more like *D. sabinus*, that is, it is broad anteriorly and narrows rapidly back toward the ventrals. It differs from *D. sabinus* and *P. hystrix* in the broad curvature across the rostral section and the sharper curves at the widest portions; its tail is much shorter than that of *D. schmardae*, being only about one and one half times the length of the body.

Professor Poey noted that he had never seen Lebisa and did not know to what genus it belonged. He introduced it in his lists of Cuban fishes because of reported use of its rasp-like skin for scouring purposes. To Professor de la Torre, in whose honor the specific name is given, is to be credited the scientific discovery of the species.

Dasybatus.

A cutaneous fold below the tail, a keel above
disk broader than long; smooth; buccal papillae 5
tail one and one half lengths of the body
brown, greenish to olive or greyish, without or with spots of white *pastinacus* (page 389)
tail nearly twice length of body; back smooth
brown, greenish to reddish . . . *brucco* (page 389)
tail about twice length of body; tubercles in a vertebral row and scattered
brown, violet to dark; buccal papillae 5, or more *violaceus* (page 390)
tail more than twice length of body; papillae 5
brown, reddish to dark; tubercles in a vertebral row, compressed *longus* (page 390)
tail about one and one half lengths of body; tubercles in vertebral and parallel rows
brown, bluish to olive; buccal papillae 3 . *hastatus* (page 391)
tail more than twice the body ; back rough; tubercles narrow, in vertebral and scapular rows
brown, yellowish to olive, uniform to spotted with darker *guttatus* (page 391)

Dasybatus pastinacus.

Pastinaca marina Belon, 1553, Aquat., p. 94, fig.; Rondelet, 1554, Pisc., **1**, p. 331, fig.; Salviani, 1554, Aquat., f. 144; Gesner, 1558, Aquat., p. 798, fig.; Willughby, 1686, Pisc., p. 67, pl. C 3.
Raia sp. 3 & 4 Artedi, 1738, Ichthyologia, Syn., p. 100, Gen. p. 71; Gronow, 1754, Mus., **1**, p. 64, no. 141.
Raia pastinaca Linné, 1758, Syst. nat., **1**, p. 232; 1766, Syst. nat., **1**, p. 396; Bloch, 1787, Ausl. fische, **3**, p. 62, pl. 82; Bonnaterre, 1788, Ichth., p. 3, pl. 3, f. 8; Gmelin, 1789, Linné Syst., **1**, p. 1509; Donovan, 1807, Br. fish., **5**, pl. 99; Risso, 1810, Ichth. Nice, p. 10.
Sting ray Pennant, 1769, Zool., **3**, p. 71.
Pastinaca Duhamel, 1782, Traité, **4**, p. 282, pl. 9, f. 8.
Dasybatus pastinaca Walbaum, 1793, Ichthyol. Enod., p. 35.
Dasyatis pastinaca Rafinesque, 1810, Ind. itt. Sic., p. 49.
Trygon pastinaca Cuv., 1817, Reg. anim., **2**, p. 136; Fleming, 1828, Brit. anim., p. 170; Jenyns, 1835; Man., p. 518; Yarrell, 1836, Brit. fishes, **2**, p. 442; Parnell, 1838, Mem. Wern. soc., **7**, p. 440, pl. 43; Müller & Henle, 1841, Plagios., p. 161; Bonaparte, 1841, Icon. Fauna Ital., Pesci, Kröyer, 1853, Danm. fiske, **3**, p. 1018; Nilsson, 1855, Fisk. Skand., p. 741; Kessler, 1859, Bull. Soc. nat. Mosc., **2**, p. 474; Duméril, 1865, Elasm., p. 600; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 478; Jensen, 1907, Dan. fiske, pt. 12, p. 340, pl. 31, f. 3.
Trygon vulgaris Risso, 1826, Hist. nat., **3**, Poissons, p. 160.
Trygon lymma Geoffroy, 1827, Descript. Egypt, **1**, p. 333, pl. 27, f. 1.
Trygonobatus pastinaca Blainv., 1830, Poiss. Fr., p. 35, pl. 6.
Pastinaca laevis Gray, 1854, Gron. syst., p. 11.
Trygon pastinaca var. *marmorata* Steindachner, 1892, Denk. Akad. wiss. Wien, **59**, p. 381, pl. 4, f. 1.

Disk subquadrangular, broader than long, anterior margins nearly straight, forming an obtuse angle beyond which the tip of the snout is slightly produced, outer angles blunted, posterior angles rounded. A line crossing the widest points of the disk passes a little backward of midway from spiracles to shoulder girdle. Head broad, rounded, width of crown half the length of snout and skull about equal depth of body. Spiracles larger than the eyes. Mouth with three to five papillæ, width less than half the distance from the end of the snout; teeth small, $\frac{46}{46}$ rows, sharper in males. Body smooth. Tail about one and one half times the length of the disk, compressed and slender behind the spine, with a short low dermal fold on the top, and a longer better developed one below originating opposite the base of the spine and ending distally in a keel.

Reddish to brownish olive, or greyish, in cases with whitish spots; lower surface white, most often with brown borders, sometimes with blotches of brown below the body cavity.

European portions of Eastern Atlantic; Mediterranean.

Dasybatus brucco.

Dasybatus brucco Bonaparte, 1841, Icon. Fauna Ital., Pesci, pl. 73; Müller & Henle, 1841, Plagios., p. 162; Duméril, 1865, Elasm., p. 602; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 477; Doderlein, 1885, Man. ittiol. Medit., **3**, p. 224; Moreau, 1891, Poiss. France. Suppl., p. 10.

Disk rhomboid, nearly one fourth wider than long, anterior and outer margins slightly convex, outer angles blunt, tip of snout a slight prominence.

Mouth waved. Eyes small; spiracles much larger. Ventrals short, subquadrangular. Tail nearly twice as long as the body, with a low fold or keel behind the spine above and a deeper longer one below. Skin smooth.

Back greenish to reddish brown; dingy white below. Hardly distinct from *D. pastinacus*, but said to attain larger size, with outlines of disk more convex.

Mediterranean.

Dasybatus violaceus.

Trygon violacea Bonaparte, 1841, Icon. Ital. Fauna, Pesci, p. 551, pl. 71; Müller & Henle, 1841, Plagios., p. 162, 200; Duméril, 1865, Elasm., p. 602; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 477; Moreau, 1881, Poiss. France, p. 449; Doderlein, 1885, Man. ittiol. Medit., **3**, p. 226.
Dasyatis (*Pteroplatytrygon*) *violaceus* Fowler, 1910, Proc. Acad. nat. sci. Phil., **62**, p. 474.

Rhomboid; length of body about two thirds of the width of the disk; snout blunt, anterior margin almost a continuous curve, subtruncate; outer margins like the anterior slightly convex; hinder angles blunted. Ventrals short rounded. Tail about twice the length of the disk, slender, with a low fold behind the spine above and a longer deeper one below. Skin smooth, with the exception of a vertebral row of tubercles from the middle of the back, and a few scattered ones on the shoulders and head. Young individuals quite smooth, very old ones with more spines and tubercles. Mouth waved. Müller and Henle found an entire row of papillae, instead of five, behind the teeth of the lower jaw.

Violaceous to dark brown above; light below.

Allied to *D. say* possibly identical.

Mediterranean Sea.

Dasybatus longus.

Plate **32**, fig. 3–4.

Trygon longa Garman, 1880, Bull. M. C. Z., **6**, p. 170.
Dasibatis longa Garman, 1882, Bull. 16, U. S. nat. mus., p. 66.
Dasyatis longa Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 85; Gilbert & Starks, 1903, Mem. Cal. acad. sci., **4**, p. 17.

Disk subquadrangular, about one sixth wider than long, anterior margins straight meeting in a blunt angle at the end of the snout, outer angles rounded. Mouth curved, with five papillæ at the bottom. Ventrals rounded. A row of small depressed and compressed tubercles behind the head on the shoulder girdle, extended backward with age. Tail more than twice as long as the body, rough with small spines, compressed behind the caudal spine, keeled above the compressed portion, a long narrow fold below. Differs from *D. latus* and *D. marinus*

in the shape of the disk and in the keel above the tail and from *D. hastatus*, a nearer ally, in the great length of the tail.

Secured by Mr. Alexander Agassiz at Acapulco, Mex.

Length of disk 11.5, length of tail 28, and greatest width 13.8 inches. A smaller individual from Panama, taken by the Hassler Expedition, has a length in body of 9.3, a length in tail of 24.5 and a width in disk of 11.2 inches. It is a light reddish brown.

Dasybatus hastatus.

Pastinaca hastata DeKay, 1842, N. Y. fish., pl. 65, f. 214.
Trygon hastata Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 261; Duméril, 1865, Elasm., p. 592.
Dasibatis hastata Garman, 1882, Bull. 16, U. S. nat. mus., p. 70.
Dasyatis hastata Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 83; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 188; Coles, 1910, Bull. Amer. mus. nat. hist., **28**, p. 338.

Disk subquadrangular, about one fourth wider than long, anterior margins nearly straight, meeting in a blunt angle at the end of the snout, outer and hinder angles rounded. Mouth with three papillae at the bottom; jaws more curved than those of *D. marinus* and less than those of *D. sabinus*. Tail about one and one half times the length of the disk, with a low keel on the top behind the spine and long deep membranous fold below, from the base of the spine backward; roughened with small spines. Back smooth in young; old with scattered small spines and with a vertebral row of narrow depressed backward-directed tubercles on the middle of the back and on the base of the tail, paralleled on each shoulder by a short row the length of which varies with age.

Bluish or olivaceous brown.

Atlantic Coasts of United States from Rhode Island to Brazil.

Dasybatus guttatus.

Plate **71**, fig. 1–2.

Iabebirete Marcgrave, 1648, Hist. nat. Brasil, p. 175.
Raia tuberculata Lacépède, 1800, Poissons, **2**, pl. 4, f. 1; Shaw, 1804, Zool., **5**, p. 290, pl. 127 (non Bonnaterre, 1788).
Raia guttata Schneider, 1801, Bloch Ichth., p. 361.
Trygon gymnura Müller, 1835, Erman's reise, p. 25, pl. 13.
Trygon tuberculata Günth., 1870, Cat. fishes Brit. mus., **8**, p. 480, part.
Dasibatus tuberculata Garman, 1882, Bull. 16, U. S. nat. mus., p. 66; 1888, Bull. M. C. Z., **17**, p. 99, pl. 41, 42.
Dasyatis gymnura Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 84; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 188.

Disk subquadrangular, little broader than long, anterior margins straight, meeting in a blunt angle beyond which the snout is produced as a rather broad-

based and triangular tip; outer angles blunted, hinder broadly rounded. Mouth small, abruptly curved, three papillae at the bottom. Teeth small, unequal, flattened and in about thirty-seven rows on the upper jaw of a female eleven inches and a half in width. Ventrals subtriangular, elongate anteriorly, broadly rounded on hinder and inner margins. Tail very slender, much more than twice the length of the body, with a narrow fin-fold below extending a short distance behind the spine, and a low keel above. Top of head, middle of back, and the tail rough with small spines; a vertebral series of tubercles with narrow depressed and more or less elongate cusps, longer above the ventrals, a short scapular row at each side near the vertebral series. Young smooth.

Back brown, yellowish to olivaceous, uniform or spotted with darker; lower surfaces white.

Brazil to the West Indies.

Amphotistius.

A cutaneous fold below the tail and another above
disk broader than long; no larger tubercles in a vertebral row
sinensis (page 393)
disk broader than long; tubercles in vertebral row, narrow, depressed
tail about twice the length of the disk; 3 buccal papillae
back chocolate-brown; a median row of tubercles
navarrae (page 393)
tail two and one fourth lengths of body; back rough; a median row of tubercles
brown, olivaceous; a short fold above the tail, a longer below; seven papillae . . . . . *fluviorum* (page 394)
tail less than two lengths of disk; buccal papillae 3; back roughened
brown, uniform to clouded; tubercles vertebral and humeral
akajei (page 394)
tail about two lengths of disk; back smooth to rough; tubercles in a vertebral row
brown with black-edged blue spots; buccal papillae 2
kuhlii (page 395)
tail one and one half lengths of body; back smooth, a tubercle on middle
brown, yellowish to dark; buccal papillae 5 . *say* (page 396)

tail one and one half lengths of body; back smooth to rough; papillae 5 brown, olive to greyish; tubercles broad based, in vertebral and scapular rows . . . . . *brevis* (page 396)

tail nearly two lengths of body; back roughened; papillae 5 brown, yellowish to dark; tubercles narrow, depressed, in median row on large specimens . . . . *sabinus* (page 397)

tail nearly two lengths of body; back smooth to rough, tubercles in median row on large brown, yellowish to reddish; no buccal papillae . *zugei* (page 398)

Dasybatus sinensis.

Trygon sinensis Steindachner, 1892, Anz. Akad. wiss. Wien, **29**, p. 133; Denk. Akad. wiss. Wien, **59**, p. 382, taf. 6.

Form rhomboid, approaching that of *D. imbricatus* but less produced in the snout and rather more convex opposite the spiracles. Disk wider than long; outer angles bluntly rounded; snout sharp; front margins waved, hinder weakly curved, and shorter; hinder angles sharply rounded. Mouth waved, with five papillae at the bottom, three close together forward and two much farther back. Eyes small; spiracles much larger. Tail slender, whip-like, about one and one half times the length of the disk, with a dermal fold below and a lower one above. Roughened with small scales above the snout, head, gills and along the vertebral column from the head back toward the caudal spine. Scales a trifle larger at the median line.

The type a mature male was 34.5 cm. in length to behind the vent and 39.5 in width; it had no large tubercles, and was uniform in color.

Shanghai.

Dasybatus navarrae.

Trygon navarrae Steindachner, 1892, Anz. Akad. wiss. Wien, **29** p. 132; Denk. Akad. wiss. Wien, **59**, p. 381, taf. 5.
Dasyatis bennetti Jordan & Richardson, 1910, Mem. Carn. mus., **4**, p. 164, pl. 65.

Disk rhomboid, broader than long, snout produced and sharp at the end, anterior outlines somewhat waved. Distance from outer angle of disk to end of snout about equal that to the vent. Outer angles blunter than hinder. Mouth waved; teeth of male with slender sharp cusps resembling those of the large tubercles on the tail; three papillae at the bottom of the mouth. Eye small; spiracles much larger. Tail, probably twice the length of the disk, with a

dermal fold below and a weaker one above behind the spine. Small scales in a longitudinal band above each eye, along the vertebral column, and grouped near the middle of the disk. Compressed backward directed tubercles in a vertebral series from the caudal spine forward. Length of disk, to behind the vent, 33 cm. and width 28 cm. in the type, a mature male from Shanghai.

Back chocolate-brown.

Dasybatus fluviorum.

Dasyatis fluviorum Ogilby, 1908, Proc. Roy. soc. Queensland, **21**, p. 6.

Disk subcircular, length eight ninths of the width; front angle obtuse, with tip slightly produced; hind borders fully and inner moderately convex; outer angles broadly and posterior somewhat narrowly rounded. Jaws undulated, upper biemarginate. Floor of mouth with seven papillae, arranged in three groups:— on each side a pair, of which the inner is the larger, the outer sometimes absent or undeveloped, and three in the middle more conspicuous and truncated. A group of small blunt tubercles above each spiracle, a transverse row of three tubercles behind the occiput from behind the median of which a series of retrorse spines extends along the dorsal ridge and is continued on the tail nearly to the base of the caudal spine. One of the median interscapular spines is slightly larger than the others of the vertebral series. Entire scapular region tuberculigerous. Length of tail two and one fourth times that of the disk. The four tubercles of the tail nearest the spine are larger than those of the back. A short fold, deeper backward, behind the caudal spine; another below the tail has its origin below the base of the spine and is much longer and slightly deeper.

Back olive-brown, margins of disk and of ventrals lighter; bluish white below, pale brown toward the margins; tail black, lower surface and sides of the proximal fourth brown.

Total length of type about 31.2 inches (794 mm.), snout to vent 9.83, width of disk 10.8, and length of tail 21.2 inches approximately.

Brisbane River, ranging above the tide waters.

Dasybatus akajei.

Trygon akajei Müller & Henle, 1841, Plagios., p. 165, pl. 54, f. 1; Schlegel, 1850, Jap. Pisces, p. 308; Bleeker, 1857, Act. Soc. sci. Ind. Neerl., **3**, p. 44; Duméril, 1865, Elasm., p. 604.
Dasyatis akajei Jord. & Everm., 1902, Proc. U. S. nat. mus., **25**, p. 319, fig. 2; Jordan & Richardson, 1910, Mem. Carnegie mus., **4**, p. 165, fig. 2.

Disk rhomboid, anterior margins nearly straight meeting in an obtuse angle at the snout; width about one fourth more than length of body. Mouth with

three papillae at the bottom. Tip of snout produced, blunted. Outer and posterior angles rounded. Spiracles larger than the eyes. Ventrals obliquely truncate, angles blunt.

Tail little longer than the body with a short low keel behind the spine above, and a more distinct and longer one below.

Skin smooth in very young; larger examples with tubercles on the middle of the back above the shoulder girdle, and more advanced stages with a vertebral row of backward-directed tubercles from the back of the head, largest on the base of the tail in front of the caudal spine, and with a parallel row on each shoulder.

Yellowish brown, darker with age; white below with darker edges; tail dark.

Japan; China.

Dasybatus kuhlii.

Trygon kuhlii Müller & Henle, 1841, Plagios., p. 164, pl. 51, f. 1; Schlegel, 1850, Jap. Pisces, p. 308; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 73; Duméril, 1865, Elasm., p. 603, Günth., 1870, Cat. fishes Brit. mus., **8**, p. 479; Day, 1878, Ind. fishes, p. 739, pl. 193, f. 2; Garman, 1885, Proc. U. S. nat. mus., **8**, p. 40; Annandale, 1909, Mem. Ind. mus., **2**, p. 34; Günther, 1910, Südsee fische, **3**, p. 494.
Raja trigonoides Castelnau, 1872, Proc. Zool. & acclim. soc. Victoria, **1**, p. 121.
Dasybatus kuhlii Garman, 1885, Proc. U. S. nat. mus., **8**, p. 40.
?Dasybatus varidens Garman, 1885, Proc. U. S. nat. mus., **8**, p. 40.
Dasyatis kuhlii Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 659.

Disk rhomboid; anterior margins slightly convex, meeting at a very blunt angle on the end of the snout; outer margins nearly straight, outer angles blunt, posterior of about 90°. Snout short, not produced. Eyes prominent. Spiracles as large as the eyes. Mouth waved, with two papillae at the bottom; teeth small, unequal, a larger sharper series on each of the convex bends in the upper jaw. Ventrals rather elongate, obliquely rounded behind. Tail about twice as long as the body in young, above with a short low fold behind the spine, below with a deeper longer one gradually disappearing at some distance from the end of the tail. Skin smooth on the young, later a vertebral series of depressed tubercles appears from the shoulder girdle forward, to be still later continued backward to the caudal spine.

Back brownish with blue black-edged spots, and smaller spots of black, scattered over the disk and with a blackish band, containing numerous small spots of black and including a light band between the forward parts of the eyes, crossing the head to the bases of the pectorals. Tail blackish with irregular rings of white in the distal portion. Lower surface whitish with darker edges.

Specimen described obtained by Dr. Thomas Barbour in southern Celebes. Snout to abdominal pores 6, pores to end of tail 12, and greatest width $8\frac{1}{2}$ inches.

Japan to India; East Indies.

D. varidens differs from this species in a broader disk and lack of spots. It may be that this form represents a variety of *D. kuhlii* distinguished by lack of dorsal spots and caudal rings.

Dasybatus say.

Raia say Lesueur, 1817, Journ. Acad. nat. sci. Phil., **1**, p. 42, pl.
Trygon sayi Müller & Henle, 1841, Plagios., p. 166; Duméril, 1865, Elasm., p. 603.
Myliobatis sayi DeKay, 1842, N. Y. fish., p. 376; Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 262.
Dasyatis sayi Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 48; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 86; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 189, pl. 19.
Dasibatis sayi Garman, 1882, Bull. 16, U. S. nat. mus., p. 69.

Disk subquadrangular, little wider than long; anterior margins nearly straight, meeting at the end of the snout in a blunt angle; hinder and inner margins convex. Mouth with five papillae at the bottom; upper jaw undulated, lower prominent in the middle; teeth small; sharp in adult males, smooth in females. Ventrals rounded. Tail rather more than one and one half times the length of the disk, with a short fold behind the caudal spine above and a longer little deeper one below ending about opposite the end of the upper. Body and tail smooth; a single rounded tubercle on the middle of the back. Allied to *D. pastinacus* but more blunt at the end of the snout, more rounded on the pectoral angles and longer in the tail.

Olive-brown, lighter to yellowish on young; white below.

New York to southern Brazil.

Dasybatus brevis.

Plate **32**, fig. 5–6.

Trygon brevis Garman, 1880, Bull. M. C. Z., **6**, p. 171.
Dasybatis dipterurus Jordan & Gilbert, 1881, Proc. U. S. nat. mus., **4**, p. 31; Garman, 1882, Bull. 16, U. S. nat. mus., p. 71.
Dasyatis dipterura Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 48; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 85.
Dasibatis brevis Garman, 1882, Bull. 16, U. S. nat. mus., p. 70.
Dasyatis hawaiensis Jenkins, 1904, Bull. U. S. fish. comm., **22**, p. 421, pl. 1, f. 1; Jord. & Everm., 1905, Bull. U. S. fish. comm., **23**, p. 48, pl. 4, f. 1.
Trygon hawaiensis Günther, 1910, Südsee fische, p. 494.

Disk subquadrangular, rounded, little wider than long, anterior margins meeting in a blunt angle at the end of the snout, outer and hinder extremities

without trace of angles. Mouth with five papillae, outer small; upper jaw indented in the middle. Ventrals broad, truncate, angles rounded. Tail less than one and one half times the length of the disk, with a short, elevated fold behind the spine and a longer deeper one below. The folds widen backward and end opposite one another. Disk naked in young. Adults have three rows of tubercles on the back placed as those of *D. hastatus*. A large specimen from Payta, has three broad-based tubercles in front of the caudal spine and the tail is roughened with smaller ones. The short rows on the shoulders contain from one to four tubercles each.

This species differs from *D. hastatus* in the shorter tail, the rounder disk, and in the shapes and sizes of the tubercles and the fin folds; it differs from *D. sayi* in a greater development of fin folds and in their shapes and length. These folds on *D. brevis* are short and deep; they rise gradually and end abruptly.

Olive or greyish brown, reddish near the edges; white below, with round spots of brown under the base of the tail.

Length of body 17, of tail 23, and width of disk 18 inches.

In a young male the length of body is 8.1, of the tail 12, and the width of the disk 9.2 inches.

Taken at Payta, Peru, and San Diego, Cal., by the Hassler Expedition.

Dasybatus sabinus.

Trygon sabina Lesueur, 1824, Journ. Acad. nat. sci. Phil., **4**, p. 10 extra, pl. 4, *Raia sabina;* Müller & Henle, 1841, Plagios., p. 103; Duméril, 1865, Elasm., p. 607.
Trygon osteosticta Müller, 1835, Erman's reise, p. 25, pl. 14.
Trygon tuberculatus Duméril, 1865, Elasm., p. 605; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 480 (part).
Dasyatis sabina Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 49; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 49.
Dasibatis sabina Garman, 1882, Bull. 16, U. S. nat. mus., p. 68.

Disk subcircular, anterior margins waved, concave opposite the nostrils, meeting in an angle that is little less than 90°, outer angles broadly rounded, hinder and inner margins convex. Mouth moderate, with five papillae at the bottom, with jaws abruptly bent forward in the middle of each side, and with symphyseal angles rather broad, or truncate. Teeth small unequal, with sharp cusps at the symphysis, on the males, in forty-eight rows on the upper jaws of an adult of ten inches in width. Top of head and middle of back somewhat roughened by small spines; a median row of sharp, elongate, compressed and depressed tubercles on back and on base of tail, and one or two similar tubercles at each side of it on the shoulder girdle. Tail less than twice the length of the

disk, roughened by small spines, with a dermal fold above and a deeper longer one below. A fully developed male measures in length from snout to abdominal pores 9.4, in length of tail 15 and in width of disk 10 inches.

Yellowish brown; white beneath.

North Carolina to Brazil, entering fresh waters.

The mouth of this species resemble that of *Dasybatus sephen* but the symphyses are less pointed, that is they appear more truncate. *Trygon osteosticta* Müll., 1835 cannot be separated from this species.

Dasybatus zugei.

Plate **71**, fig. 3 (skeleton).

Trygon zugei Müller & Henle, 1841, Plagios., p. 165, pl. 54, f. 1; T. Cantor, 1849, Malay. fishes, p. 426; Schlegel, 1850, Jap. Pisces, p. 309; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 68; Duméril, 1865, Elasm., p. 606; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 481; Day, 1878, Ind. fishes, p. 739, pl. 190, f. 3; Annandale, 1909, Mem. Ind. mus., **2**, p. 33, pl. 4, f. 2.
Trygon crozieri Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 45.
Dasyatis zugei Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 660.

Disk subquadrangular, rounded on outer angles and posteriorly; snout much produced, acute, "sharper than any other trygon," length about three times the width of the interorbital space. Eyes small, eyelid nearly straight. Spiracles larger than the eyes. Mouth waved, without papillae; teeth sharp, in 52 rows on the upper jaw of a specimen at hand. Tail nearly twice as long as the body, with a short low fold above, behind the spine, and a longer deeper one below. Ventrals subtriangular, anterior rays much the longer, angles blunted. Disk smooth in young; older with scattered tubercles in the vertebral series. Large individuals have a more or less complete median series, and have the tail roughened by small spines. The greatest width is nearly opposite the mid length of the body.

In one specimen the length from snout to abdominal pores is $10\frac{1}{4}$ and the width $9\frac{1}{8}$ inches; in another the distance from snout to pores is $3\frac{1}{4}$, that across the disk $3\frac{1}{8}$, and that from the pores to end of tail $6\frac{1}{8}$ inches.

Yellowish to reddish brown; white below.

Penang; China; India; Japan; East Indies.

Taeniura.

Taeniura Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117; Wiegm. arch., p. 400; 1841, Plagios., p. 171.
Discobatis Maclay & Macleay, 1885, Proc. Linn. soc., N. S. W., **10**, p. 676.
Discotrygon Fowler, 1910, Proc. Acad. nat. sci. Phil., **62**, p. 468.

Disk rounded, pectoral fins meeting in front of skull, no rostral cartilage. Anterior nasal valves confluent, with free lateral and posterior edges, median attachment narrow. Mouth small, with papillae, velum fringed. Teeth small, tessellate, grooved transversely. Cranium prominent; fontanel broad and rounded in front of the skull, narrow between the orbits. No dorsal fin. Ventrals elongate, anterior rays longer than posterior. Tail longer than the body, with a spine above, in front of the middle of the length and with a rayless subcaudal fin below the distal portion.

This genus may be subdivided into two sections:— the first, Taeniura proper, type *T. lymma*, characterized by its round disk, much waved mouth, unequal teeth, subtriangular ventrals, convex skull, etc., the second, Taeniurops, containing *T. meyeni* and *T. atra* more nearly allied to species of Dasybatus, distinguished by greater width of disk, straighter mouth, less diversity in the teeth, less convexity in the cranium, less inequality in the ventral rays, the fins being more quadrangular, etc.

Disk round; skin smooth, or in greater age with a few small spines
mouth sharply curved, with 2 papillae; teeth unequal
greyish with rounded dark edged spots of blue . *lymma* (page 399)
Disk broader than long; skin rough
mouth curved, with 2 papillae;
greyish with spots of black . . . . *melanospila* (page 400)
Disk broader than long; skin smooth
Mouth straight, with 5 papillae
blackish . . . . . *meyeni* (page 400)
Disk broader than long; skin rough
a short vertebral series of rounded tubercles
brown to black . . . . . *atra* (page 401)

Taeniura lymma.

Plate **53**, fig. 4 (pelvis); Plate **55**, fig. 7 (vertebrae); Plate **71**, fig. 4–5 (skeleton).

Raia lymma Forskáel, 1775, Descript. Anim., p. 17; Gmelin, 1789, Linné Syst., **1**, p. 1511.
Raia lymnia Bonnaterre, 1788, Ichth., p. 5.
Raia lymna Schneider, 1801, Bloch Ichth., p. 365; Shaw, 1804, Zool., **5**, p. 287.
Trygon lymna Cuv., 1817, Reg. anim., **2**, p. 137.
Trigon lymma Rüppell, 1828, Atlas fische, p. 51, pl. 13, f. 1; 1835, Neue wirb. Abyssinien, Fische, p. 69.
Trygon halgani Lesson, 1830, Voy. Coquille, Poiss., **2**, p. 100, pl. 3; Guerin, 1838, Icon. Poiss., pl. 69, f. 3.
Trygon ornatus Gray & Hardwicke, 1832, Ill. Ind. Zool., **1**, pl. 99.
Taeniura ornata Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117; 1838, Charlesworth's mag., **2**, p. 90.

Taeniura lymma Müller & Henle, 1841, Plagios., p. 171, pl. 55, f. 3; Duméril, 1865, Elasm., p. 619; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 483; Klunzinger, 1871, Syn. fishe, **2**, p. 241; Günther, 1910, Südsee fische, **2**, p. 495.
Taeniura lymna T. Cantor, 1849, Malay. fishes, p. 430.
Discobatis marginipinnis Maclay & Macleay, 1886, Proc. Linn. soc. N. S. W., **10**, p. 676, pl. 46, f. 7–15; Jord. & Seale, 1906, Bull. U. S. fish. comm., **25**, p. 183.
Discotrygon marginipinnis Fowler, 1910, Proc. Acad. nat. sci. Phil., **62**, p. 462.

Disk subcircular, snout not produced. Mouth small, width about one third of the distance from the end of the snout, with a fringed velum and two papillae at the bottom. Teeth small, unequal, tessellate, with transverse ridges, or sharp cusps on males. Chin papillose. Cranium prominent convex longitudinally, descending sharply forward; foramen in front broad and rounded, narrow or closed between the orbits on the crown. Pectorals angled posteriorly. Ventrals elongate, subtriangular, anterior rays much longer than posterior, angles rounded. Tail longer than body, spine about mid length, supracaudal fin absent, or rudimentary, origin of subcaudal slightly in front of spine, depth greater than that of the muscles above it. Skin smooth.

Greyish brown with rounded spots of blue irregularly scattered over back and fins.

Total length $16\frac{1}{2}$, body to pores $6\frac{1}{2}$, and greatest width 7 inches.

Red Sea; Singapore; Mauritius; Fiji Islands.

Taeniura melanospila.

Taeniura melanospilos Bleeker, 1853, Nat. tijds. Ned. Ind., **4**, p. 513; Duméril, 1865, Elasm., p. 620.
Taeniura melanospila Günth., 1870, Cat. fishes Brit. mus., **8**, p. 484; Klunzinger, 1871, Syn. fische, **2**, p. 242.

Disk broader than long, obtuse in front. Snout length six times in the greatest width of the disk. Mouth curved, two papillae at the bottom. Skin rough, a dorsal series of tubercles. Tail rough, depressed in the basal portion, little longer than the disk. Spine inserted little behind the first third of the tail, subcaudal fin deeper, extending from below the insertion of the spine to the end of the tail.

Back greenish grey, with numerous rounded spots of blackish.

Batavia.

Taeniura meyeni.

Taeniura meyeni Müller & Henle, 1841, Plagios., p. 172; Duméril, 1865, Elasm., p. 620; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 483.

Disk a little broader than long; margins and fins rounded. Upper eyelid slightly produced. Mouth straight; teeth with transverse groove as in Dasy-

batus. Tail as long as the disk, with a low keel above near the end; subcaudal fin as deep as the muscular portion, of equal depth to the end.

Blackish brown above; below white with blackish edges on pectorals and ventrals.

Mauritius.

Taeniura atra.

Taeniura atra Macleay, 1883, Proc. Linn. soc. N. S. W., **7**, p. 598.
Taeniura mortoni Macleay, 1884, Proc. Linn. soc. N. S. W., **8**, p. 212.

Disk broader than long, subround. Tail less than twice the length of the disk, with a deep cutaneous fin under the terminal half. Skin rough with small spines, depressed tubercles, three or four, in a vertebral series on the middle of the disk, in the scapular region.

Black, on the back of a sixteen inch specimen; white below.

New Guinea; Australia.

Urobatis, gen. nov.

Disk subcircular, angles and margins rounded, snout not produced. Teeth small, numerous, tessellate, with acute cusps in the male. No median series of tubercles. No dorsal fin. Ventrals short, moderately broad, subquadrangular, directed backward. Tail about as long as the body, with a spine; caudals rather deep, rounded. Embryo without an orbital process but with a long, slender, pointed postspiracular process on the spiracular tegmen.

Type *U. sloani.*

Disk little longer than broad
  tail about equal disk
    skin rough, no median tubercles
      brown, spotted with yellow . . . *sloani* (page 402)
      brownish, vermiculate with yellow . *vermiculatus* (page 402)
Disk little broader than long
  tail shorter than disk
    skin rough, no median tubercles
      brownish, clouded . . . . . *nebulosus* (page 403)
Disk subcircular
  tail shorter than disk
    skin smooth
      brown, with yellow spots and vermiculations . *halleri* (page 403)
      brownish gray, with spots of brown . *maculatus* (page 404)

Urobatis sloani.

Plate **28**; Plate **53**, fig. 3 (pelvis); Plate **69**, fig. 4–5 (skeleton).

Pastinaca marina Sloane, 1725, Hist. Jam., **2**, p. 277, pl. 246, f. 1.
Leiobatus sloani Blainv., 1816, Bull. Soc. philom., p. 121.
Trygon jamaicensis Cuv., 1817, Reg. anim., **2**, p. 137; 1829, ibid., p. 400.
Trygonobatus torpedinus Desmarest, 1823, Mem. Soc. Linn. Paris, **2**; Bory, 1828, Dict. class. hist. nat., **14**, p. 449; ibid., **16**, p. 131, pl. 116.
Raia sloanii Bancroft, 1830, Zool. journ., **5**, p. 83.
Urolophus torpedinus Müller & Henle, 1841, Plagios., p. 173, pl. 56, f. 1; Poey, 1858, Memorias Cuba, **2**, p. 360; Duméril, 1865, Elasm., p. 628; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 485; Garman, 1885, Proc. U. S. nat. mus., **8**, p. 41.
Urolophus jamaicensis Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 81.

Disk longer than broad, anterior half little wider, margins all convex, tip of snout hardly produced, bluntly rounded. Head small, of little prominence. Eyes small, orbital length about equal the interorbital width. Spiracles larger than the eyes. Mouth small, distance from end of snout two and one third times that between the nostrils, with five papillae at the bottom, upper velum with a prominent fringe, lower fringe weak. Teeth broader than long, lozenge-shaped, on the crown, sharp in males, in $\frac{23}{21}$ rows in eight inch specimen, $\frac{27}{25}$ in fourteen inch. Basal portion of tail depressed, with a rudimentary fold at each side; distal portion compressed; origin of supracaudal fin at end of the spine, and of subcaudal below its base; spine inserted about mid length of the tail; entire length of tail about equal that of disk. Skin rough with small spines on head, dorsum, and top of tail to upper edge of caudal; outer portions of disk, on pectorals and ventrals, and lower surfaces are smooth.

Brownish thickly covered with round spots of yellow, small on middle of disk and larger toward margins, and on ventrals and caudal.

Sloane says of the species "it had several asperities on the skin, and was of a brown color with yellow spots here and there"; this description of the markings agrees with that of the form, shown on Plate **28**, common around Haiti. The young as taken from the oviduct are shown Plate **28**, fig. 2, 3.

Urobatis vermiculatus, var. nov.

Plate **29.**

In most respects this form is not to be distinguished from that common about Jamaica and Haiti and, probably, the islands to the eastward. *U. sloani* is more brown than yellow; it is spotted with round yellow spots. *U. vermiculatus* is more yellow than brown; it is vermiculate with brown and the brown is not confined to the upper surfaces. The vertebral region in this form is darker

and in cases the brown contains transverse cloudings or indefinite bands on body and tail. The specimen figured on Plate 29 is one of a number taken at Progreso, Yucatan, by Dr. L. J. Cole. It represents a variety of *U. sloani*, rather than a distinct species.

Urobatis nebulosus.

Urolophus nebulosus Garman, 1885, Proc. U. S. nat. mus., **8**, p. 41; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 80.

Disk subround resembling that of *U. halleri* but differing from that species in being rough with asperities over the posterior portion of the abdomen. No median series of tubercles on back or tail. Three small papillae at the bottom of the mouth.

Entire length of the type 12, snout to ends of ventrals 7.5, snout to ends of pectorals 7 and greatest width 7 inches.

Clouded olivaceous brown on the back; whitish below.

Colima, Mex.

Urobatis halleri.

Urolophus halleri Cooper, 1863, Proc. Cal. acad. sci., **3**, p. 96; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 46; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 80.
Urolophus umbrifer Jord. & Starks, 1895, Proc. Cal. acad. sci., ser. 2, **5**, p. 285; Jord. & Everm., 1900, Bull. 47, U. S. nat. mus., p. 2752.

Disk subcircular, front outlines meeting at a very blunt angle at end of snout. Nasal valves short, outer angles not produced, hind margin fringed. Mouth small, waved, width nearly half the preoral length; teeth small, tessellate. Eyes small, orbit about one fifth the length of the snout; spiracles larger. Ventrals short, broad, rounded. Tail near two thirds the length of the disk, fins moderately deep, spine inserted in end of anterior half. Skin smooth. A close ally of *U. sloani* but rounded.

Specimen in hand $20\frac{1}{2}$ inches, tail from the pores $8\frac{1}{2}$, greatest width $12\frac{1}{4}$.

In a lot of more than a hundred examples secured by Professor Louis Agassiz at San Diego, California there is a considerable amount of individual variation in colors. Most of the specimens are brown with small spots of yellow, very small on some, larger on others, smaller toward the margins, thickly strewn over the entire back and tail or occasionally absent from the middle of the disk. Less numerous, perhaps, are those brown with vermiculations of yellow over the whole back or only in the central portions. Some are more yellow than brown and on some the brown is variously clouded. The back is usually darkest in the middle and on the head; the fins are lighter near and on the margins; the tail is usually not darker.

Urobatis maculatus, sp. nov.

Form of *U. halleri* but differing in the prominence of the fold along each side of the tail and in coloration. Ashy gray with small spots of black, marking the openings of the tubules of the lateral system and the ampullae, and with larger spots of brown, half as large as the eye, symmetrically arranged; a series of about seven beginning in front of each eye and passing back at the inner edge of the outer third of each pectoral, another series of about four spots each begins at each eye and parallels the first about midway between the vertebrae and the outer edge; besides these there is one spot over each gill chamber, one on each half of the shoulder girdle, one over the abdomen at each side of the vertebral column and one at the axil of the pectoral above the origin of the ventral fin. Faint dark specks appear along the sides of the tail. Outer edges of fins lighter; lower surfaces white.

One specimen, a mature male, from the U. S. Fish Commission, taken at the head of the Gulf of California, in about nine fathoms. Total length $9\frac{7}{8}$, snout to pores 5, and greatest width $5\frac{1}{2}$ inches.

Urotrygon.

Urotrygon Gill, 1863, Proc. Acad. nat. sci. Phil., p. 173.

Disk subcircular, angles and margins rounded, snout produced. Mouth waved; teeth tessellate, numerous, crowns broader than long. Tail longer than body, slender posteriorly, caudal fins narrow, pointed, with a serrated spine near mid length. No dorsal fin. A median series of tubercles. Ventrals subtriangular, anterior rays much longer than posterior, directed laterally. Embryos with a longer strongly curved orbital process and a shorter blunt postspiracular process on the spiracular tegmen.

Type *U. mundus*.

Species of this genus are the most nearly related to the freshwater Potamotrygons of South America.

Disk broader than long
- tail longer than disk
  - skin smooth, with median tubercles on back and tail
    - brown, with black specks . . . *chilensis* (page 405)
  - skin spinose, on snout, median tubercles on back
    - brown, uniform . . . . . *goodei* (page 405)

skin smooth, median tubercles on tail
brown uniform . . . . . *aspidurus* (page 405)
Disk round
tail little longer than disk
skin with stellate based spines and tubercles
brown, uniform . . . . . *mundus* (page 406)

UROTRYGON CHILENSIS.

Urolophus chilensis GÜNTHER, 1871, Proc. Zool. soc. London, p. 653, pl. 53.

Disk broader than long, snout projecting a little, tail longer than the disk. Disk smooth, but with tubercles along the median line, viz. three in a single series on the middle of the back and two on the tail in front of the spine.

Back nearly uniform brownish with a few indistinct specks of darker brown.

Günther's figure so closely represents the species later described as *U. aspidurus*, differing mainly in the anterior position of some of the tubercles, as to raise doubt of the validity of that species.

UROTRYGON GOODEI.

Urolophus goodei JORDAN & BOLLMAN, 1890, Proc. U. S. nat. mus., **12**, p. 151; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 81; BOULENGER, 1898, Boll. Mus. zool. anat. Torino, **13**, no. 329, p. 1.

Disk "to posterior base of pectorals" broader than long, anterior margins little convex from the eyes outward. Tip of snout prominent, sharp. Eyes small, four thirteenths of the snout. Interorbital width one half the snout, equal the width of mouth. Ventrals projecting beyond the disk. Tail little longer than disk; caudals elongate, from end of spine equal snout and eye.

Body of young nearly smooth, excepting a spine or more on the middle of the back and a few prickles on the snout.

Brown, paler toward edges; caudal dark above, lighter edged.

Described from young specimens, of from six to seven inches in length.

Off the coast of Colombia, South America, Bay of Panama, and Bay of Santa Helena.

UROTRYGON ASPIDURUS.

Plate **69**, fig. 3 (skeleton).

Urolophus aspidurus JORDAN & GILBERT, 1882, Bull. U. S. fish. comm., **1**, p. 307; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 81; GILBERT & STARKS, 1904, Mem. Cal. acad. sci., **4**, p. 16.

Disk broader than long, snout prominent, margins nearly straight for a short distance in front, outer and posterior angles and margins rounded. Outer

angle of ventrals acute, anterior rays three or four times as long as the posterior. Tail strong, tapering to a slender point, depressed anteriorly, longer than the disk including the ventrals; caudal spine inserted in the end of the anterior half; caudal fins not deep, origin of supracaudal at end of spine of subcaudal farther forward. Skin smooth, excepting above the vertebrae from above the pelvis, on the back to the caudal spine where there is a series of broad-based compressed and depressed backward directed sharp tubercles, 1–9, absent on young. Eyes small, less than half as long as the spiracle, length less than one fourth of their distance apart. Mouth small, nearly one third the length of the snout, arched forward, a median papilla at the bottom. Teeth in $\frac{44}{44}$ rows. Total length 15, tail from pores 8, and width $7\frac{3}{4}$ inches.

Of a large number of specimens no two are alike in number and positions of the tubercles, and in all cases they are supracaudal, between pelvis and caudal spine.

Hardly to be separated from *U. chilensis* Günther, 1871.

Panama. Hassler and John E. Thayer Expeditions, numerous examples.

Urotrygon mundus.

Plate **30**, fig. 1–2.

Urotrygon mundus Gill, 1863, Proc. Acad. nat. sci. Phil., p. 173.
Urolophus asterias Jordan & Gilbert, 1882, Proc. U. S. nat. mus., **5**, p. 579; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 82.
Urolophus rogersi Jordan & Starks, 1895, Proc. Cal. Acad. sci., ser. 2, **5**, p. 388.

Disk nearly round, little longer than wide if the ventrals are included, snout slightly produced. Tail strong and depressed anteriorly, slender backward, with spine inserted about mid length. Eyes small, length of orbits two and one half times in their distance apart, nearly six times in the length of the snout. Spiracles larger than the eyes. Mouth small, width two and one half times in its distance from the end of the snout. Velum at the bottom deeply fringed. In an eight inch male, fully mature, the teeth are in $\frac{29}{28}$ rows and have long sharp cusps. Nostrils small, anterior valves short, with narrow median attachment in front of the mouth. Shoulder girdle in the posterior half of the disk including the ventrals. Pelvis arched forward in the middle. Ventrals broad, short, outer angles blunt, claspers short, stout, crooked. Caudal narrow, pointed, like that of *U. chilensis*. Spines small to very small, stellate-based, sprinkled somewhat losely over the entire disk, rather more thickly in front of the head

little larger toward the middle of the body or the tail. Total length, of a young example, $8\frac{1}{4}$, tail $4\frac{1}{4}$, and greatest width $4\frac{1}{4}$ inches.

Clouded or rusty brownish; white around nostrils at tip of snout and beneath the disk.

Gulf of California to Panama.

Urolophus.

Urolophus Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117.

Disk subquadrangular, narrower posteriorly, anterior margins waved meeting at a blunt angle in front, snout little produced. Ventrals short, broad, anterior rays and posterior subequal, directed backward. Tail shorter than the body, stout, with a spine; caudals short, of moderate depth, rounded behind. No dorsal fin. Papillae at the bottom of the mouth.

Type *U. cruciatus*.

Disk much broader than long
- tail short
  - back spinose, a tubercle on the shoulder girdle
    - spotted with black . . . . . *armatus* (page 407)
  - back smooth, no tubercles
    - banded and blotched with dark . . *cruciatus* (page 408)
- tail little shorter than body
  - back smooth, no tubercles
    - brown, uniform . . . . . *kaianus* (page 409)

Disk about as broad as long
- tail little shorter than body
  - back smooth
    - brown on back, white below middle of disk *fuscus* (page 409)

Urolophus armatus.

Urolophus armatus Müller & Henle, 1841, Plagios., p. 174; Duméril, 1865, Elasm., p. 628; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 485; 1910, Südsee fische, **3**, p. 495.

Separated from *U. cruciatus* by broadness of disk, greater production of snout, armature, and by coloration. Mouth sinuous; teeth flat, in a young male. Scattered spines above the snout, on the back of the head, along the middle of the back and in a row on the tail. A larger spine on the shoulder girdle.

Brown with more or less scattered rounded darker spots; white below, with darker edges.

New Ireland.

Urolophus cruciatus.

Raia cruciata Lacépède, 1804, Ann. mus., **4**, p. 201, 210, pl. 55, f. 2.
Leiobatus cruciatus Blainv., 1816, Bull. Soc. philom., p. 121.
Urolophus cruciatus Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117; 1838, Charlesworth's mag., **2**, p. 90; Duméril, 1865, Elasm., p. 626; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 485; Waite, 1899, Mem. Austr. mus., **4**, p. 43.
Urolophus aurantiacus Müller & Henle, 1841, Plagios., p. 173, pl. 56, f. 2.
Urolophus ephippiatus Richardson, 1848, Erebus & Terror, Fish, p. 35, pl. 24; Duméril, 1865, Elasm., p. 627.

Disk subquadrangular, blunt forward, width greater than length of body, widest in front of the shoulder girdle, narrowing back toward the ventrals, tip of snout slightly produced, outer angles and margins broadly and hind angles sharply rounded, anterior margins sinuous, indented opposite the eye. Body rather thick, head moderately prominent. Mouth small, curved, width less than half the distance from tip of snout, with three papillae at the bottom — median bifurcate. Teeth tessellate, lozenge-shaped, broader than long, with a slight transverse excavation on the crown. On the specimen in hand, a male, there are four rows of the flattened teeth at each side of seventeen rows each tooth of which is provided with a long sharp longitudinally grooved cusp. Eye of moderate size, spiracle small. Anterior rays of ventrals little if any longer than posterior. Tail, from the pores, two thirds as long as the body, caudal fins of medium depth, end rounded, spine inserted about mid length. Skin smooth.

Brown, rusty or yellowish, with a vertebral band of darker crossed by about three bands in front of the shoulder girdle, behind which it is paralleled by two to four longitudinal bands over the abdomen. The specimen shows the brown of the outer portions of the pectorals to be separated from that of the back by a curved band of light color from opposite the eyes to the middle of the hind border of the pectorals; it also has dark blotches in front of the eyes. Lower surfaces whitish with broad brown outer margins on pectorals and ventrals. Colors evidently varying much in different individuals.

Length 12.5, tail from the pores 5, and greatest width 8.1 inches; from Hobart, Tasmania.

Australian seas.

Urolophus kaianus.

Urolophus kaianus Günther, 1880, Challenger rept. Zool., **1**, p. 37.

Disk broader than long, front angle very obtuse, snout not projecting. No dorsal fin. Tail little shorter than disk. Skin smooth. Snout to vent four and three eighths, end of tail to vent four and one half, and greatest width five and five sixths inches. Specimens described eight and seven eighths and nine and one fourth inches in total lengths.

Uniform brownish.

Ki Islands, at 129 fathoms.

Urolophus fuscus.

Urolophus fuscus Garman, 1885, Proc. U. S. nat. mus., **8**, p. 41; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 657.

Disk subquadrangular, hardly as broad as long, front margins meeting in a blunt angle, tip of snout prominent. Eye small, orbit as long as the spiracle. Interorbital space as wide as the mouth, which is less than half the distance between tip of snout and mouth. Mouth medium, curved forward, with three papillae on its floor, middle one bifurcate. Tail from vent equal to distance from vent to front of nostril, fin depths moderate, end blunt, spine inserted little in front of mid length. Ventrals rather short and broad, claspers short and stout. Skin smooth.

Total length $12\frac{1}{2}$, snout to pores 7, and greatest width $7\frac{3}{5}$ inches.

Back, tail and lower edges of fins reddish brown or olive, elsewhere white.

Japan.

Trygonoptera.

Trygonoptera Müller & Henle, 1841, Plagios., p. 174.

Disk subquadrangular, narrower backward, angled in front, outer and hinder angles rounded. Ventrals short, broad. Tail shorter than the disk, not thread-like, with rayed caudal fins, and with a small dorsal in front of the spine near mid length.

Angle at junction of front margins very blunt

back uniform reddish brown . . . . . *testacea* (page 410)

back spotted . . . . . *javanica* (page 410)

Angle at junction of front margins nearly right

back uniform brown . . . . . *bucculenta* (page 410)

Trygonoptera testacea.

Trygonoptera testacea Müller & Henle, 1841, Plagios., p. 174; Duméril, 1865, Elasm., p. 629; Waite, 1899, Mem. Austr. mus., 4, p. 44.
Trygonoptera mülleri Steindachner, 1866, Sitzb. Akad. wiss. Wien, **53**, p. 479, pl. 6, f. 5 (young).
Trygonoptera henlei Steindachner, 1866, *loc. cit.*, pl. 6, f. 4 (half grown).
Trygonoptera australis Steindachner, 1866, *loc. cit.*, p. 480, pl. 7.
Urolophus (*Trygonoptera*) *testaceus* Günth., 1870, Cat. fishes Brit. mus., **8**, p. 486.

Disk subrhomboid, outer and hinder angles and margins rounded, front margins nearly straight, snout blunt-angled not produced. Spiracle with a projection from the inner edge. Nasal valves fringed. Six short papillae at the bottom of the mouth. Tail little shorter than the disk in adults, little longer in young. Dorsal fin and spine near the middle of the tail. Skin smooth. Uniform reddish or brownish.

Australia.

Trygonoptera javanica.

Trygonoptera javanica Martens, 1864, Monatsb. Akad. wiss. Berlin, p. 260.
Urolophus (*Trygonoptera*) *javanicus* Günth., 1870, Cat. fishes Brit. mus., **8**, p. 486.

Disk little longer than broad. Thirteen papillae at the bottom of the mouth. Back with lighter and with darker spots. Allied to *T. testacea*.

Batavia.

Trygonoptera bucculenta.

Urolophus bucculentus Macleay, 1884, Proc. Linn. soc. N. S. W., **9**, p. 172.
Trygonoptera bucculenta Waite, 1899, Mem. Austr. mus., **4**, p. 45, f. 3, pl. 5.

Disk including the ventrals as broad as long, anterior margins nearly straight, meeting in a blunt angle; outer and hinder angles blunted. Interorbital space one third of the length from the middle of the eye to the end of the snout. Spiracle larger than the eye. Anterior nasal valves not extended back from the narrow isthmus, outer angles rather sharp, elongate. Teeth blunt, in about eighteen rows. Ventrals somewhat narrow and long. Tail shorter than the disk; a moderate sized dorsal and a spine near the middle; caudal fins of moderate depth.

Dark brown on back and lower margins of disk, elsewhere yellow.

Teeth larger, disk broader and more angular, tail shorter, dorsal larger and rounder, and caudal deeper than in *T. testacea*.

Australia.

Aëtoplatea.

Aëtoplatea Müller & Henle, 1841, Plagios., p. 175.

A small dorsal fin in front of the spine on the base of the tail; otherwise as in Pteroplatea.

A tentacle behind the spiracle
  tail less than half as long as the body
    keeled above and below . . . . *tentaculata* (page 411)
No tentacle behind the spiracles
  tail about as long as the body . . . . *zonura* (page 411)

Aëtoplatea tentaculata.

Aëtoplatea tentaculata Müller & Henle, 1841, Plagios., p. 175; Duméril, 1865, Elasm., p. 630.
Pteroplatea tentaculata Günth., 1870, Cat. fishes Brit. mus., **8**, p. 488; Annandale, 1909, Mem. Ind. mus., **2**, p. 40; pl. 4, f. 4.
Pteroplatea australis Ramsay & Ogilby, 1885, Proc. Linn. soc. N. S. W., **10**, p. 575; 1888, ibid., ser. 2, **2**, p. 1024.

Shapes similar to those of *Pteroplatea poecilura* or *P. micrura*. Disk about twice as wide as long, anterior edges of pectorals waved, posterior nearly straight. A tentacle behind the spiracle. No papillae in the mouth. Teeth acute. Tail nearly half as long as the body, with a fold above and another below. Dorsal small, rounded. Skin smooth. A serrated caudal spine.

Greenish brown with scattered spots of lighter on the back; tail brown.

Red Sea; Indian Ocean; Malabar.

Aëtoplatea zonura.

Aëtoplatea zonurus Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 79; Duméril, 1865, Elasm., p. 631.
Pteroplatea zonura Günth., 1870, Cat. fishes Brit. mus., **8**, p. 488; Annandale, 1909, Mem. Ind. mus., **2**, p. 40, pl. 4, f. 3.

Disk twice as wide as long. Front outline of pectoral very little waved, outer angle slight, posterior margin and angle rounded. A small prominence at end of snout, distance from the eyes less than that between the spiracles on a specimen eleven inches in width. No tentacle behind the spiracle. Tail from the abdominal pores less than half the length of the body; a low keel above and another below; spine not yet apparent on the individual described; dorsal fin small, rounded.

Greenish brown with maculae and puncticulations of black; lower surfaces white; tail brown with white rings, 8–10, behind the dorsal.

Singapore; Batavia.

Pteroplatea.

Pteroplatea Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 117; 1841, Plagios., p. 168.

Disk much broader than long, lozenge-shaped, with angles rounded, depressed and thin; head not prominent. Eyes small, prominent. Nostrils wide, separated by a broad isthmus; anterior valves confluent, crossing the isthmus as a narrow fold; posterior valves rudimentary. Spiracles large, immediately behind the eyes. Mouth wide, transverse, little arched; jaws slender; teeth minute, numerous, in a broad band, each tooth broad-based, with 1–3 sharp cusps. Pectorals broad, meeting in front of the head. Ventrals small, narrow. Tail short, slender, with or without narrow dermal folds behind the serrated spine. No dorsal fin. Shoulder girdle, Plate **72**, *pct.*, broad and flat below.

Temperate and tropical seas.

Dorsal fin absent
- tentacle absent behind the spiracle
  - tail nearly as long as the body
    - dermal folds or keels absent . . . *poecilura* (page 412)
  - tail about half as long as the body
    - dermal fold below, weak . . . *japonica* (page 413)
  - tail less than half as long as body
    - dermal fold beneath, low . . . . *hirundo* (page 413)
    - dermal fold above slight . . . *crebripunctata* (page 413)
    - dermal fold below weaker than upper . . *micrura* (page 414)
    - dermal folds upper and lower well developed *marmorata* (page 414)
- tentacle present
  - tail less than half as long as body
    - dermal folds narrow above and below . *altavela* (page 415)

Pteroplatea poecilura.

Tenkee kunsul Russell, 1803, Coromandel fishes, **1**, no. 6, fig.
Raia poecilura Shaw, 1804, Zool., **5**, p. 291.
Trygon kunsua Cuv., 1829, Reg. anim., **2**, p. 400.
Trygon poecilurus Bennett, 1830, Mem. Raffles, p 694.
Pteroplatea micrura Müller & Henle, 1841, Plagios., p. 169; T. Cantor, 1849, Malay. fishes, p. 427; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 76; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 37; Duméril, 1865, Elasm., p. 613; Day, 1865, Fishes Malabar, p. 278; 1878, Ind. fishes, p. 741, pl. 194, f. 2; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 487; Annandale, 1909, Mem. Ind. mus., **2**, p. 39.
Pteroplatea annulata Swains., 1839, Class., **2**, p. 319.
Dasyatis micrura Gray, 1851, Chondropterygii, p. 122.

Shape resembling that of *P. micrura*, Plate 33, f. 3. No tentacle. No dorsal. A caudal spine. In specimens of a width of fifteen inches the length is about half the width of the disk. Snout with a slight prominence, distance from eyes to tip about equal to distance between spiracles. Length of tail nearly equal that of the body, varying from two thirds of the body length; folds absent or indistinct. On a specimen from Penang the tail is nine tenths of the length of the body and there are white spots scattered over the back. In most cases the back is uniform brown and the lower surfaces are white. Müller and Henle mention an individual spotted with white as being in the British Museum but do not give its locality. Tail with transverse blotches and with rings of black and of white, nine to eleven of each. Usually the hindmost are rings and the anterior but transverse bands. Rounded spots of brown may or may not occur in the white interspaces.

Red Sea; India; Calcutta; Penang; Java.

Pteroplatea japonica.

Pteroplatea japonica Schlegel, 1850, Jap. Pisces, p. 309, pl. 141; Bleeker, 1857, Act. Soc. sci. Ind. Neerl., **3**, p. 45; Duméril, 1865, Elasm., p. 614; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 662.
Dasyatis micrura var. *japonicus* Gray, 1851, Chondropterygii, p. 122.
Pteroplatea hirundo Ishikawa & Matsuura, 1897, Cat. fishes, p. 60.

Form like that of *P. poecilura* or *P. micrura;* distinguished from the latter by a shorter tail, about half the length of the disk, and by a smaller number of broader bands on the tail, five to eight behind the spine. No tentacle; no dorsal.

Japan.

Pteroplatea hirundo.

Pteroplatea hirundo Lowe, 1843, Proc. Zool. soc. London, p. 94; Garman, 1888, Bull. M. C. Z., **17**, p. 100, pl. 43, f. 1.

A close ally of *P. japonica*, but with a shorter tail, less than half the length of the body, without a fold above and with a low one below. No tentacle. No dorsal fin. A caudal spine. Skin smooth. Uniform brown.

Madeira.

Pteroplatea crebripunctata.

Pteroplatea crebripunctata Peters, 1869, Monatsb. Akad. wiss. Berlin, p. 703; Jord. & Starks, 1895, Proc. Cal. acad. sci., ser. 2, **5**, p. 390; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus. p. 87; 1898, ibid., p. 2753.
Pteroplatea rava Jord. & Starks, 1895, Proc. Cal. acad. sci., ser. 2, **5**, p. 387; Jord. & Everm., 1898, Bull. 47, U. S. nat. mus., p. 2754.

Snout to abdominal pores half the width of the disk. Tip of snout a slight prominence. Anterior margin of pectoral waved, concave in the middle, outer and hinder angles rounded somewhat broadly. No tentacle on the spiracle. No dorsal fin. Tail less than half the length of the body, with a slight fold above, behind the spine.

Brown with black puncticulations; yellowish below. Rarely with white spots.

Gulf of California.

Pteroplatea micrura.

Plate **33**, fig. 3–4.

Raia micrura Schneider, 1801, Bloch Ichth., p. 360.
Raia maclura Lesueur, 1817, Journ. Acad. nat. sci. Phil., **1**, p. 41, fig.
Trygon maclura Cuv., 1829, Reg. anim., **2**, p. 400.
Pteroplatea maclura Müller & Henle, 1841, Plagios., p. 169; Duméril, 1865, Elasm., p. 614; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 487; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 86.
Pastinaca maclura DeKay, 1842, N. Y. fish., p. 375, pl. 65, f. 213.

Length of disk more than half the width. A low angle in front of the snout. A slight indentation in front of the middle of each pectoral; outer ends of pectorals subangular, hind margins and angles broadly rounded. Length of snout from the eyes of a specimen sixteen inches wide equals the distance between the spiracles. The caudal spines appear later on individuals of this species, which is one reaching a great size.

No tentacle behind the spiracle. Tail slender, tapering, with a distinct fold above and a weaker one below, entire length little more than one fourth of the length of the body from the snout to the pores.

Olivaceous or brownish puncticulate and vermiculate with lighter; tail dark with four or five bands or blotches of lighter.

The only items of importance in Bloch's description of *Raia micrura* concern the tail, "nigro alboque fasciata," and the locality, "Habitat in Surinamo." These would fix the name *micrura* upon the West Indian species, later described by Lesueur as *R. maclura*, rather than on the East Indian form figured by Russell and named by Shaw *Raia poecilura*.

Pteroplatea marmorata.

Pteroplatea marmorata Cooper, 1863, Proc. Cal. acad. sci., **3**, p. 112; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 47; Garman, 1888, Bull. M. C. Z., **17**, p. 101, pl. 43, f. 2; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 87.

Disk less than twice as wide as long. Anterior margin of pectoral waved in young, slightly concave in the middle, nearly straight and snout longer and

more angular on old males. Length of snout from eyes greater than distance between spiracles. Tail from the pores one third the length of the body from the same point, with a well-developed fold above and a wider one below. Caudal spines present on the embryo before extrusion. No tentacle behind the spiracle. Adults are rather more angular forward than most other species and the disk as a whole is more of a triangle.

Large specimens dark brown marmorate with lighter; young lighter to ashy with lighter marmorations and whitish spots.

Off Californian coasts.

Pteroplatea altavela.

Plate **53**, fig. 6 (pelvis); Plate **57**, fig. 3 (heart); Plate **72** (skeleton).

Pastinaca marina altera πτερυπλατεῖα, Altavela dicta Columna, 1616, Aquat., C 2, p. 4, pl. 2; Willughby, 1686, Pisc., p. 65, pl. c1, f. 3; Ray, 1713, Pisc., p. 24.

Raia altavela Linné, 1758, Syst. nat., **1**, p. 232; Gmelin, 1789, Linné Syst. nat., **1**, p. 1509.

Raia pastinaca β Altavela, Linné, 1766, Syst. nat., **1**, p. 396.

Dasyatis attavilla Rafinesque, 1810, Ind. itt. Sic., p. 49.

Trygon altavela Lowe, 1839, Proc. Zool. soc. London, p. 92; Bonaparte, 1841, Icon. Fauna Ital., Pesci, fig.

Pteroplatea altavela Müller & Henle, 1841, Plagios., p. 168; Duméril, 1865, Elasm., p. 611; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 486; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 181.

Pteroplatea canariensis Valenciennes, 1843, Ichth. Canar., p. 100, pl. 23, f. 1; Duméril, 1865, Elasm., p. 611.

Pteroplatea valencienni Duméril, 1865, Elasm., p. 612; Garman, 1888, Bull. M. C. Z., **17**, p. 101, pl. 44, 45.

Pteroplatea vaillantii Rochebrune, 1880, Bull. Soc. philom., ser. 7, **4**, p. 159; 1882, Acta Soc. Linn. Bord., **36**, p. 54, pl. 2.

A tentacle behind the spiracle. Length of snout, on young, less than the distance between the spiracles. Width of disk twice its length, including the ventrals. Length of the tail from the abdominal pores little less than half that of the body. Tail with a narrow fold above and another below behind the spine. No dorsal fin.

Back brown, marmorate or vermiculate with lighter; tail brown with about six transverse bands behind the spine.

The figure of *P. vaillantii* from Senegambia shows straighter margins, sharper angles, and coarser marmorations; manifest inaccuracies in other respects induce uncertainty as to how much reliance is to be placed on these items.

Tropical Atlantic; Mediterranean; Brazil.

Potamotrygonidae.

Body, head, and pectorals much depressed forming a broad rounded disk. Pectoral fins meeting in front forming the snout, without a supporting rostral

cartilage. Mouth small, transverse, with papillae at the bottom. Teeth small, in a band or pavement. Nostrils large; anterior valves meeting on a narrow isthmus, reaching the mouth. Tail tapering to filamentary, with lateral longitudinal folds on the base with vertical fin-folds on the distal portion, and in most genera, if not all, with a serrated spine. Anterior copula of the branchihyal cartilages segmented. Pelvis with a median prepelvic process.

Mouth at a moderate distance from the anterior margin
  disk circular
    base of tail elongate; caudal spine remote
      spiracular process absent . . *Potamotrygon* (page 416)
    base of tail short; no caudal spine . *Elipesurus* (page 424)
Mouth far from the anterior margin
  disk elongate elliptical
    base of tail short; caudal spine proximal
      spiracular process present . . . *Disceus* (page 426)

Potamotrygon.

Potamotrygon Garman, 1877, Proc. Bost. soc. nat. hist., **19**, p. 210.
Dynatobatis Larrazet, 1886, Bull. Soc. Geol. France, ser. 3, **14**, p. 258.

Disk subcircular. Mouth, eyes, and spiracles rather nearer to the anterior margins than to the shoulder girdle. Spiracles without a process on the outer border. Mouth with papillae at the bottom. Ventrals subtriangular; pelvis with a prepelvic process in the middle. Lateral system of the lower surface not retiform. Tail with elongate depressed base, a remotely placed serrated spine, with cutaneous folds above and below, and with a low keel along each side of the base.

Species have been described from the South American Tertiary in the Rio Parana Section.

Disk nearly round
  base of tail equal more than half the length of body
    mouth abruptly curved; teeth unequal
      interspiracular width nearly equal length of snout
        laticeps (page 417)
    mouth waved; teeth subequal
      interspiracular width one third length of snout *scobina* (page 418)

mouth waved, small, width two fifths length of snout
curved forward; teeth equal . . *circularis* (page 419)
Disk longer than wide
tail longer than disk, tuberculate on top and sides
mouth medium, width two thirds of distance from end of snout
waved, teeth nearly equal . . . *humerosus* (page 419)
mouth small, width two fifths of distance from end of snout
curved; teeth small, flattened, inward angle sharp
spotted with light and with dark . *signatus* (page 420)
mouth small; tail with median row of tubercles
reticulate with brown; spots yellow *magdalenae* (page 421)
mouth small, curved, with two papillae
tail with median and lateral tubercles
spotted with scattered spots of light on brown
hystrix (page 422)
mouth small, curved, with five papillae
tail with median and lateral tubercles
spotted with yellow . . . *motoro* (page 423)
Disk circular
tail more than twice length of disk . . . *orbicularis* (page 423)
Disk broader than long
tail shorter than body, median tubercles on base
a net-work of blackish streaks . . . *brachyurus* (page 424)
tail much longer than disk, with median tubercles
a net-work of hexagonal meshes . . . *reticulatus* (page 424)

Potamotrygon laticeps, sp. nov.

Plate **31**, fig. 3–4; Plate **55**, fig. 6 (vertebrae).

Disk subround, little longer than wide, slightly narrowed posteriorly. Mouth moderate, in width half its distance from the end of the snout, with rather abrupt curves in the upper jaws on which some of the teeth are larger, with five papillae, and a sixth behind the median papilla. Teeth black, rather smooth, convex, of various sizes, in $\frac{39}{41}$ rows. Eyes small, distance apart one and one half times their distance from the end of the snout. Spiracles larger than the eyes, interspiracular width about equal distance from eyes to end of snout. Head broad, crown convex. Ventrals broad, angles rounded. Base

of tail strong, depressed, with lateral folds, length from pores to spine three fifths of that of the body from the pores forward. Tail sharply compressed above the vertebrae behind the spine, with cutaneous folds above and below. Back and tail rough with small, loosely-placed, stellate-based spines, larger on the middle of the disk. Broad based, compressed and hooked-cusped tubercles occur in irregular series above the vertebrae and along the lateral keels on the base of the tail, similar tubercles are irregularly placed along the middle of each pectoral about half way from the base to the outer margin.

Back brownish with scattered small spots of white; whitish below with brown margins and with a few scattered spots of brown over the middle. In a sketch of a young specimen in fresh condition the colors are yellowish to reddish brown, closely freckled with rusty spots of darker and there is a yellow margin on each pectoral.

Length of disk 16, width 15, and length of tail from abdominal pores to caudal spine 8 inches.

Obidos, Brazil. Thayer Expedition.

Potamotrygon scobina, sp. nov.

Disk round, tip of snout a slight prominence. Mouth small, in width one third of its distance from the end of the snout, gently waved, with five papillae. The papillae are arranged in two series: — the anterior containing a bifid median papilla and one at each angle of the mouth; and the posterior two papillae farther back than the anterior. Teeth small subequal, in $\frac{34}{25}$ rows; crowns transversely concave, rather smooth. Eyes small, lids curved outward on the edge. Spiracles little larger than the eyes greatest distance apart contained one and one half times in the length from snout to eyes. Disk and upper surface of tail covered by very small fine closely set stellate-based spines intermixed with larger above body and gills behind the head and in an area along the middle of the upper side of the tail. Behind the middle of the abdomen above the vertebrae there are two irregular rows of low, hooked broad-based tubercles extending backward upon the base of the tail. Lower surfaces smooth.

Back rusty brown with scattered small spots of whitish; ventral surfaces brownish with small spots of white and with blotches of brown.

Type an immature male from Cameta, Brazil. Length of disk $9\frac{3}{4}$ and greatest width $9\frac{3}{8}$ inches. Thayer Expedition.

Potamotrygon circularis, sp. nov.

Plate **31**, fig. 1, 2; Plate **54**, fig. 1 (pelvis); Plate **70**, fig. 1, 2 (skeleton).

Disk nearly round, little longer than broad. Mouth small, regularly curved, in width about two fifths of the distance from the end of the snout, with five papillae at the bottom. Teeth small, white on one specimen partly black on another, with concave crowns and sharp inward edges with a sharp angle or angles (on males); in $\frac{42}{40}$ rows. Eyes small, prominent, distant from the anterior margin nearly twice their distance apart. Spiracles twice as large as the eyes, interspiracular distance nearly two thirds of the length of the snout from the eyes. Ventrals broad and broadly rounded on the posterior border. Tail strong and depressed in the base, with a weak fold at each side, and slender and compressed behind the spine with a low cutaneous fold above and another below. From the abdominal pores to the caudal spine is two thirds of the length of the body to the pores. Back and tail rough with small stellate-based spines, larger toward the middle of the back. One or more large tubercles, rounded, ridged and much swollen in the base, and compressed and hooked in the short cusp, occur on each shoulder; others appear in an irregular series from above the middle of the abdomen to the caudal spine, in a row of smaller ones along each side of the base of the tail and in an irregular series or band around the sides and the forward part of the disk near the margin. The bases of the tubercles are much swollen and ridged, and in places a number of them are fused into a broad plate; the cusps are small.

Greyish brown with faint mottlings and spots of lighter and of darker, smaller toward the edges. The young appear to be light olive or yellowish profusely spotted with rounded spots slightly darker or reddish. Lower surface chocolate-brown with blotches of white below the gills and anteriorly. The young are more nearly white on the lower surfaces.

Length of disk in one specimen $14\frac{3}{4}$, width $14\frac{1}{4}$; in another the length is $16\frac{3}{4}$, and the width 16 inches.

Teffé, Brazil. Thayer Expedition.

Potamotrygon humerosus, sp. nov.

Disk oval, longer than wide, snout from the eyes longer than the greatest distance between the spiracles. Mouth moderate, width about two thirds of the distance from the end of the snout, with five papillae, curves not abrupt.

Teeth small, nearly equal, in $\frac{28}{27}$ rows, crowns flattened, broad, inner edge rounded and with a median and one or more lateral small sharp cusps. Eyes small, prominent, distance apart less than two fifths of the distance from the tip of the snout, lids curved outward. Spiracles more than twice as large as the eyes, greatest distance apart less than length of snout. Body and head deep as compared with the other species. Scales of the top of the disk sharp, stellate-based, loosely set, larger over the middle of the body, absent near the margins. Very irregular, closely set, broad-based, tubercles with tall hooked cusps occupy the entire top of the tail between the lateral folds, and extend forward above the abdomen and backward behind the caudal spine. Base of tail nearly half as long as the body.

Back brown, with indefinitely outlined spots of blue or greyish, larger than the spiracles, separated by wide spaces. Ventral surface white in the middle with scattered spots of brown; fins broadly margined with brown marbled with white; inside of mouth and throat brown with white mottlings. Tail brown or black, with spots of white below the base and in transverse bands behind the spine.

Length of disk $11\frac{1}{2}$, greatest width $10\frac{1}{2}$, snout to abdominal pores $10\frac{1}{2}$, pores to base of caudal spine $5\frac{1}{2}$ inches.

Type (♀) from Montalegre, Brazil, on the Lower Amazon.

Potamotrygon signatus, sp. nov.

?Trygon hystrix Schomburgk, 1843, Fishes Guiana, **2**, p. 180 (part), pl. 20 (smooth figure only).

Disk subelliptical, a little longer than wide, with regular curvatures, the shape behind the middle closely resembling that in the forward half. Eyes much smaller than the spiracles, prominent. Mouth small, curved, width two fifths of the distance from the end of the snout, one half of the interspiracular distance and one third of the distance from the eye to the end of the snout, with five papillae at the bottom. Anterior nasal valves confluent, reaching the mouth, median attachment narrow. Teeth small, flattened on the crown with a sharp angle directed inward, in $\frac{30}{28}$ (to $\frac{34}{30}$) rows, outer chestnut colored or rusty, inner white. Entire upper surface of body covered with small stellate-based sharp-cusped spines, larger on the middle of the body and along the vertebral column. Top of tail with like protection besides a median dorsal series of (about eighteen) broad-based tubercles with high sharp compressed hooked points. Sides of tail naked. Base of tail, from pores to spine, four

sevenths of the distance from snout to pores. Tail behind the spine compressed, sharp keeled on the top, with a low membranous fold above and a narrower one below.

Back brown, darker from the head backward, thickly marked with round spots of light color, some of them united into short bands. Near the outer edge of the disk and parallel with it there is a series of about twenty spots of the lighter color each of which has a crescent-shaped spot of blackish at its outer edge, on openings of pores; inside of this series the spots are larger. Individuals vary in regard to size of spots, on the larger one described above they are smaller than on the other and the brown color forms a net-work somewhat resembling that on *P. magdalenae*. Lower surface of disk white, darker toward the hinder margins; lower surface of tail blotched and clouded with brown, darker backward.

One specimen has a length of disk of 6, and a width of $5\frac{1}{2}$ inches, another, a mature male, measures $8\frac{1}{4}$ inches in length of disk and $7\frac{1}{2}$ in width.

Two specimens were secured by Prof. L. Agassiz, the Thayer Expedition, from the Rio Poty a tributary of the Paranahyba River, Brazil, and a third from the Paranahyba at San Gonçallo.

Potamotrygon magdalenae.

Taeniura magdalenae Duméril, 1865, Elasm., p. 625; Steindachner, 1878, Denk. Akad. wiss. Wien, **39**, p. 72, pl. 15.

Potamotryon magdalenae Eigenmann, 1892, Proc. U. S. nat. mus., **15**, p. 25; Steindachner, 1902, Denk. Akad. wiss. Wien, **72**, p. 148.

Disk oval, little longer than wide, snout with a slight prominence. Mouth small, with five papillae; teeth flat. Tail longer than the disk, with a cutaneous fold above and another below, and with a median series of compressed hooked tubercles in front of the spine. Back rough with numerous small asperities, among which larger blunter tubercles are mixed, smaller toward the margins.

Brown with lighter yellowish spots, as large as the eye and smaller, so numerous and close together that the brown appears as a net-work over the disk and tail.

Closely allied to *P. hystrix* and *P. motoro*, but distinguished by the coloration and by the armature; the base of the tail being without lateral series of tubercles.

Magdalena River.

Potamotrygon hystrix.

Pastenaque de Humboldt Roulin, 1829, Ann. sci. nat., **16**, p. 104, pl. 3, f. 1–3.
Trygon hystrix Müller & Henle, 1841, Plagios., p. 167; Schomburgk, 1843, Fishes Guiana, p. 180, pl. 20; d'Orbigny, 1847, Voy. Amer. Mer., **5**, Poissons, p. 11, pl. 15; Castelnau, 1855, Anim. nouv., Poiss., p. 103; Duméril, 1865, Elasm., p. 608 (part); Günth., 1870, Cat. fishes Brit. mus., **8**, p. 482 (part); Goeldi, 1897, Bol. Mus. Para., **2**, p. 455.
Trygon (Tacnura) d'orbignyi Castelnau, 1855, Anim. nouv., Poiss., p. 102, pl. 49, f. 1.
Tacnura orbignyi Duméril, 1865, Elasm., p. 624; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 484.
Potamotrygon humboldtii Garman, 1877, Proc. Bost. soc. nat. hist., **19**, p. 210.
Potamotrygon hystrix Eigenmann, 1892, Proc. U. S. nat. mus., **15**, p. 25 (name only).
Potamotrygon d'orbignyi Eigenmann, 1892, Proc. U. S. nat. mus., **15**, p. 25 (name only).
Ellipesurus orbignyi Ribeiro, 1907, Arch. Mus. nac., **14**, p. 186.
Ellipesurus hystrix Ribeiro, 1907, Arch. Mus. nac., **14**, p. 185.

Disk oval, little longer than wide, rounded in front and behind. Mouth moderately undulated, with two papillae at the bottom. Teeth flattened, heart shaped, somewhat sharp in males. Eyelid straight. Upper surfaces rough with small loosely and irregularly distributed stellate-based spines, larger toward the middle and absent from the margins. With age the median spines of the tail and back and those near them become enlarged more numerous and ridged on the bases. The tail has a rather closely set row of subconical tubercles, from base to spine, and bears a series of smaller ones along each side from base to end. Tail longer than body, rarely entire except on very young, with a serrated spine situated behind the body about two thirds the length of the latter, compressed behind the spine, with cutaneous folds above and below. Similar to *P. motoro.*

Back brown with scattered areas of lighter; whitish below, darker toward margins; tail brownish on young, blotched on the sides with darker and lighter, banded behind the spine.

Müller and Henle gave the localities Surinam, Maracaibo, and Buenos Aires.

The drawings by Schomburgk and by d'Orbigny agree with the foregoing in shapes and armature but differ somewhat in markings; they appear rusty to greenish brown with numerous small, more or less light-edged, elongate or worm-like spots of darker. The description of *P. orbignyi* by Castelnau would place it nearer *P. motoro;* the figure is closer to *P. hystrix;* it was taken in the Tocantins, the locality for *P. dumerili, P. mülleri,* and *P. henlei.* A specimen of the Pastenague de Humboldt taken by the Thayer Expedition and sketched with the colors of life has the markings described by Roulin. Apparently it is a young *P. hystrix.* Roulin did not give a Latin name.

Potamotrygon motoro.

Taeniura motoro Müller & Henle, 1841, Plagios., p. 197; Duméril, 1865, Elasm., p. 624; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 484.
Trygon garrapa Schomburgk, 1843, Fishes Guiana, **2**, p. 182, pl. 21; Müller & Troschel, 1848, Schomburgk's reisen, **3**, p. 642.
Trygon (*Taenura*) *dumerilii* Castelnau, 1855, Anim. nouv., Poiss., p. 101, pl. 48, f. 1.
Trygon (*Taenura*) *mulleri* Castelnau, 1855, ibid., pl. 48, f. 2.
Trygon (*Taenura*) *henlei* Castelnau, 1855, ibid., pl. 48, f. 3.
Potamotrygon motoro Garman, 1877, Proc. Bost. soc. nat. hist., **19**, p. 211; Eigenmann, 1892, Proc. U. S. nat. mus., **15**, p. 25.
Ellipesurus motoro Ribiero, 1907, Arch. Mus. nac., **14**, p. 185.

Disk oval almost round. Mouth with five papillae; teeth flat. Upper eyelid slightly produced in the middle. Back rough, except at the edges, with stellate-based spines, stronger near the vertebral column on disk and tail. Base of tail with a row of compressed round-based spines which extends forward with age on the hinder part of the back; sides of tail rough to the end. Tail as long as the disk, with a serrated spine remote from the body, and with a cutaneous fold above and another below.

Brown with numerous round spots of yellow to orange, more often ocellated by black edges, on back and tail, fainter near the margins below the disk and under the tail.

Originally described from the Cuyaba, apparently found in both the Plata and the Amazon systems. Müller and Henle appear to have had some doubts in regard to the differences between this species and *P. hystrix*.

Potamotrygon orbicularis.

?Aiereba Marcgrave, 1648, Hist. nat. Brasil., p. 175, fig.; Jonst., 1649, Pisc., pl. 38, f. 6; Willughby, 1686, Pisc., p. 48, pl. C1, f. 2.
Raia orbicularis Schneider, 1801, Bloch Ichth., p. 361.
Trygon aiereba Müller & Henle, 1841, Plagios., p. 160.
Trygon (*Paratrygon*) *aiereba* Duméril, 1865, Elasm., p. 594 (part).
Trygon orbicularis Günth., 1870, Cat. fishes Brit. mus., **8**, p. 482 (part).

Disk as wide as long, spiracles nearly one fifth of the length of the disk from the front margin; about one seventh of the same length equals their distance apart. "Os inferius habet, haud amplum, edentulum; incisurae quasi parabolicae." Tail slender, more than twice as long as the body, with two spines near the middle of its length. Length of disk and width equal, 21 inches each; length of tail four feet.

Back reddish, covered in the middle with small tubercles; lower surfaces white.

A doubtful species, known only from Marcgrave's description.

Potamotrygon brachyurus.

Trygon brachyurus Günther, 1880, Ann. mag. nat. hist., ser. 5, **6**, p. 8.
Potamotrygon brachyurus Eigenmann, 1892, Proc. U. S. nat. mus., **15**, p. 25 (name only).

Disk broader than long. Eyes small, length two fifths of the width of the skull between them. Spiracles about twice the size of the orbit. Mouth with five papillae. Tail much shorter than the body, with a low fold above, behind the spine, and a lower one below; with a series of small tubercles on the median line in front of the caudal spine.

Back greyish brown with a coarse net-work of blackish streaks; white below, with blackish margins.

Length of disk 10, of tail 9, and greatest width 12 inches.

Buenos Aires.

The measurements given by Günther make this species and the next following differ from all others in the genus by being broader than long in the disk, in which they agree with Dasybatus rather than Potamotrygon. Further details are necessary before they can be placed with any degree of certainty.

Potamotrygon reticulatus.

Trygon hystrix Günth., 1870, Cat. fishes Brit. mus., **8**, p. 482 (part).
Trygon reticulatus Günther, 1880, Ann. mag. nat. hist., ser. 5, **6**, p. 8.
Potamotrygon reticulatus Eigenmann, 1892, Proc. U. S. nat. mus., **15**, p. 25 (name only).
Elipesurus reticulatus Ribeiro, 1907, Arch. Mus. nac., **14**, p. 185.

Disk ovate, rounded in front. Mouth with four papillae at the bottom. Eyes of moderate size, half as wide as the skull between them. Spiracles nearly twice the width of the orbit. Back with small stellate-based asperities; margins of disk smooth. A series of irregularly arranged moderate sized tubercles on the median line of the tail. Tail much longer than the disk, with a low fold above, behind the spine, and a lower one below.

Back brown with a net-work of wide hexagonal meshes in black lines; white below.

Length of disk $7\frac{1}{2}$, tail 12, and greatest width $8\frac{1}{2}$ inches.

Surinam.

Elipesurus.

Elipesurus Schomburgk, 1843, Fishes Guiana, **2**, p. 184.

This genus, with its type species *E. spinicauda*, was reproduced by Sir William Jardine from Schomburgk's notes and drawing. It was not specially

characterized. The short spiny tail, without a serrated caudal spine, and the positions of eyes and spiracles, remove it sufficiently from either Potamotrygon or Disceus. *E. strongylopterus*, in lacking the tubercles and possessing a serrated caudal spine on the tail, differs from the type. It is included only as a doubtful species, and it may not belong to the genus.

Elipesurus spinicauda.

Elipesurus spinicauda Schomburgk, 1843, Fishes Guiana, **2**, p. 184, pl. 23; Duméril, 1865, Elasm., p. 582; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 472; Eigenmann, 1892, Proc. U. S. nat. mus., **15**, p. 25 (name only); Ribeiro, 1907, Arch. Mus. nac., **14**, p. 184.

Disk oval, about 18 inches in length by $14\frac{1}{2}$ or 15 in width. Eyes large, prominent, lids with a process behind the orbit. Nostrils very large. Spiracles large, without a process on the outer margin. Tail short, without a serrated spine, but with strong spiny excrescences covering its base, the only organs of defence with which the animal is furnished. Schomburgk's figure shows the tail tapering to a point, as if complete, and to be about one third of the length of the disk. The eyes are in the anterior fifth of the disk.

Bright ochreous yellow, covered with a series of dark reticulated markings the meshes of which are about the size of the eye. Our only information concerning this animal is contained in the description and figure published by Schomburgk. The form differs from the species of Disceus in the anterior position and large size of eyes and spiracles, and in lacking the spiracular process and serrated caudal spine. Though it is a doubtful species, it is one that, like *Elipesurus strogylopterus*, collectors may yet hope to secure.

? Elipesurus strogylopterus.

Trygon strogylopterus Schomburgk, 1843, Fishes Guiana, **2**, p. 183, pl. 22; Müller & Troschel, 1848, Schomburgk's reisen, **3**, p. 642.
Trygon (Himantura) strogylopterus Duméril, 1865, Elasm., p. 592.
Trygon strongyloptera Günth., 1870, Cat. fishes Brit. mus., **8**, p. 476.
Paratrygon strongylopterus Eigenmann, 1892, Proc. U. S. nat. Mus., **15**, p. 24 (name only).
Ellipesurus strongylopterus Ribeiro, 1907, Arch. Mus. nac., **14**, p. 184.

Disk circular, about as long as wide. Tail about one third as long as the disk, thick at its insertion, becoming suddenly attenuate and continuing slender to the end, armed at a short distance from its extremity by a serrated spine.

Yellowish umber-brown with a narrow border of dull reddish brown; the whole surface covered over with irregular markings and freckles of dark umber-brown. Not recognized since Schomburgk. Differs from *Elipesurus spinicauda*

in the circular disk, the absence of a process behind the eyelid, the presence of a serrated caudal spine, the absence of tubercles on the base of the tail and in having a slight prominence on the anterior margin of the spiracles. It agrees with *E. spinicauda* in position of eyes, mouth, and spiracles near the anterior borders and in shapes of tail and fins. The short tail with the caudal spine near the disk separates this form from the Potamotrygons. It appears to be an intermediate between Potamotrygon and Disceus that may be expected in future collections. At present it is placed among the doubtful species. Müller and Troschel say it belongs in the group of Trygons without fins on the tail; they also say the complete tail is two thirds of the length of the disk. According to these authors the teeth occupy only the middle third of the mouth and are arranged in twelve longitudinal rows; this and the proportions they give their specimen make it appear to belong to the genus Disceus, but they say nothing of a spiracular process which, if it had been present, they would hardly have overlooked.

Disceus.

Disceus Garman, 1877, Proc. Bost. soc. nat. hist., **19**, p. 208.

Disk subelliptical, longer than broad. Nostrils, mouth, eyes, and spiracles small, near the middle of the disk. Spiracles with a strong process on the outer border. Ventral fins triangular, covered by the pectorals; pelvis with a long prepelvic process from the middle. Lateral system of the lower surface retiform. Tail slender, with a serrated spine near the disk and with cutaneous folds above and below the filiform portion.

Disceus thayeri, sp. nov.

Plate **34**; Plate **54**, fig. 2 (pelvis); Plate **57**, fig. 2 (heart); Plate **70**, fig. 3 (skeleton).

Disceus strongylopterus Garman, 1877, Proc. Bost. soc. nat. hist., **19**, p. 208; 1888, Bull. M. C. Z., **17**, p. 95, pl. 35 (non Schomburgk).
?Trygon aiereba Müller & Henle, 1841, Plagios., p. 196 (non p. 161, non Marcgrave).

Disk elliptical, truncate or concave in front. Head small, at the end of the anterior third of the disk. Eyes very small, far apart, prominent. Spiracles small, with a strong process on the outer margin. Mouth small, regularly arched forward, with two papillae at the bottom, less distinct in large specimens. Teeth small, bands extending halfway from symphysis to angles, in sixteen to nineteen rows on each jaw, flat, triangular, and sharp-edged on the crown.

Ventrals covered by the pectorals, subtriangular, outer rays longer, angles rounded. Tail less than one and one half times as long as the disk, depressed, with a serrated spine close to the body; base short, irregularly armed above by subconical broad-based tubercles; filiform in the posterior portion with low cutaneous folds above and below, more distinct on the young. Young smooth; older ones rough with small sharp-cusped scales the bases of which have radiating ridges also with sharp cusps. The tubercles vary greatly in number and size; the bases are more or less swollen and fused into plates each bearing a number of cusps. Length of disk 8.8, greatest width 7.7, tail from vent 13.3 inches.

Back light yellowish brown irregularly marked with spots and streaks of brown, Plate 34, more uniform rusty brown with age; lower surfaces white, clouded or blotched with brown on large individuals.

Secured by the Thayer Expedition at Obidos, Manaos, and Para, Brazil.

A second species of this genus is accounted for by a photograph and measurements furnished by Professor Eigenmann. Compared with *D. thayeri* it is more elongate and more narrowed toward each end of the disk; the width of the disk is five sixths of the length, and eyes, spiracles, and mouth are nearer to the front margin, which is not concave. The tail is very short, probably mutilated; its base tapers rapidly, at its end bears a couple of serrated spines, and is armed on its forward portion by a median series of half a dozen strong tubercles which posteriorly are flanked by three similar ones on each side. Smaller tubercles appear behind the spines.

Color nearly uniform brownish. Length of disk $21\frac{1}{4}$, width 17.7 and length of tail 5.11 inches.

The form appears to be intermediate between those of *Elipesurus spinicauda* of Schomburgk and *Disceus thayeri;* it differs from the former in that the eyes and spiracles are farther back, that the spiracle has the process on its outer border, and that the tail is provided with a serrated spine.

The locality given is the Jurua river, a southwestern affluent of the Upper Amazon above Teffé.

Myliobatidae.

Body, head, and pectorals forming a broad lozenge-shaped disk. A pair of rostral fins, joined in front of the snout, either separated from the pectorals or connected with them at the side of the head. Teeth angular, broad, flat, tessellated, median series commonly broader than the laterals, if any. Eyes prominent, lateral. Spiracles large, behind the eyes, opening laterally. Cra-

nium prominent. Tail long, slender, whip-like, bearing on the basal portion a small dorsal fin and behind it in most genera a serrated spine.

Rostral fins united in one lobe
- teeth in more than three rows on each jaw
  - side of head not free from the pectorals
    - caudal spine present . . . *Myliobatis* (page 428)
  - side of head free from the pectorals
    - caudal spine absent . . . . *Actomylaeus* (page 434)
    - caudal spine present . . . . *Pteromylaeus* (page 437)
- teeth in one row on each jaw
  - caudal spine present . . . . *Aëtobatus* (page 440)

Myliobatis.

Myliobatis Cuv., 1817, Reg. anim., **2**, p. 137.

Disk broad. Head moderately prominent. Pectorals slightly falciform, continued along the side of the head to the end of the snout, where they are joined forming a single lobe. Teeth tessellate, in 7 rows, median broader, lateral narrow. Anterior nasal valves confluent in a broad flap with free margin in front of the mouth. Ventral fins short, broad. Dorsal small, between the ventrals. A serrated spine above the base of the tail behind the dorsal. Tail long, slender.

Numerous species have been determined among Tertiary fossils, and others from those of the Cretaceous and the Jurassic.

Temperate and tropical seas.

Snout short, broad, rounded
- flange connecting pectorals and rostrals rather wide
  - pectorals with broad, rounded tips
    - dorsal origin 1 length of the base behind the bases of the ventrals *californicus* (page 429)
  - pectorals with tips of moderate width
    - dorsal origin 2 lengths of the base behind ventral bases *peruvianus* (page 430)
  - pectoral tips somewhat pointed, blunt
    - dorsal origin 3 lengths of base behind ventral bases *goodei* (page 430)

flange at side of head narrow
pectoral tips narrow, rounded
dorsal origin more than 2 lengths of base behind ventral bases
aquila (page 431)

Snout elongate, pointed
flanges moderately wide
pectoral tips narrow, pointed
dorsal origin $1\frac{1}{2}$ lengths of the base behind bases of ventrals
freminvillii (page 432)

flanges narrow
pectoral tips moderate, rounded
dorsal origin $1\frac{1}{2}$ lengths of base behind ventral bases
tobijei (page 433)

Snout short, broad, rounded
flanges (?) rather narrow
pectoral tips narrow, pointed
dorsal origin near 1 length of the base behind bases of ventrals
spotted or barred with blue or white *tenuicaudatus* (page 433)

MYLIOBATIS CALIFORNICUS.

Plate **49**, fig. 4–6.

Rhinoptera vespertilio GIRARD, 1856, Proc. Acad. nat. sci. Phil., p. 137; 1857, Journ. Bost. soc. nat. hist., **6**, p. 544, pl. 26.
Holorhinus vespertilio GILL, 1862, Proc. Acad. nat. sci. Phil., p. 331.
Myliobatis californicus GILL, 1865, Ann. N. Y. lyc., **8**, p. 137; JORDAN & GILBERT, 1882, Bull. 16, U. S. nat. mus., p. 51; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 89.

Width of disk less than twice the length of the body or a little more than half of the total length in a specimen of twenty-two inches. Each pectoral nearly as long as broad, not falciform, broadly rounded at the outer extremity, nearly straight on the anterior margin, slightly convex on the posterior, acute in the hinder angle and convex on the inner free margin. Rostral fins broad across the end of the snout, moderately wide at the side of the head, where joining the pectorals. Skull broader than long; fontanel broad in front, broad and rounded posteriorly. Median teeth three to five times as wide as long, Plate **49**, fig. 4–6. Anterior nasal valves confluent in a broad flap, free behind, with rounded angles and a narrow fringe at the mouth. Ventrals broader than long, subtruncate, with rounded angles. Dorsal small, low, highest in the middle

longest in the base, origin one length from the ends of the bases of the ventrals. A serrated spine behind the dorsal. Tail more than twice the length of the body.

Snout to vent $6\frac{1}{2}$, vent to end of tail $15\frac{1}{4}$, and width $11\frac{7}{8}$ inches in the specimen of which the teeth are shown Plate **49**, fig. 4.

Back dark brown, bronzed or greenish; lower surfaces white, darker toward outer ends.

California.

Myliobatis peruvianus, sp. nov.

Plate **36**, fig. 4–6; Plate **55**, fig. 8; Plate **73**, fig. 2.

Width of disk less than twice the distance from snout to vent; anterior margins nearly straight, posterior concave; outer angles rounded, blunt. Skull broader forward, subtruncate; fontanel broad in front, tapering to a point backward. Rostral fins narrower forward, meeting the pectorals at a point opposite the angles of the mouth in rays the length of which is hardly equal to the width of the eye. Teeth in the median row about four times as broad as long, Plate **36**, fig. 6. Dorsal small rounded on upper margins, longest on the base, origin behind the ends of the ventrals, or two lengths of the base behind the bases of the ventrals. A serrated spine.

Philippi, 1892, An. Mus. nac. Zool., **1**, Chile, p. 6, Plate 3, fig. 1, described *Myliobatis chilensis* from an abnormal specimen of four feet and a half in width. Neither description nor figure give data by which its place in the system can be determined; it had twelve rows of teeth, of which the outermost row at each side was wider, the fifth was widest and the others were of varying widths, the connection between the pectorals and the rostrals was very broad, the outer angles of the disk were very sharp, and the tail was shorter than the body. The dentition, the angles of the disk, and the comparative length of the tail are peculiar; the snout resembles that of *M. goodei*, in the width of the pectoral along the side of head, more than that of any other of the known species.

Myliobatis goodei.

Myliobatis goodei Garman, 1885, Proc. U. S. nat. mus., **8**, p. 39; Jord. & Everm., 1898, Bull. 47, U. S. nat. mus., p. 2755.

Disk less than twice as broad as long, outer angles rather widely rounded, anterior border very little convex, hinder concave in its outer half, convex in the inner, posterior angle blunt. Head of little prominence; fontanel broad on the

forehead, narrowing abruptly then tapering gradually, or nearly parallel, rounded behind. Rays of rostral fins at side of head nearly as long as those in front of the snout, making a broad flange connecting rostrals and pectorals. Teeth in the median series three to four times as wide as long, the third row is about two thirds, and the second half as wide as the median, while the teeth in the outer row are as broad as long. Eyes very small; no horn above the orbit. Spiracle more than three times the length of the eye. Dorsal small, rounded above, fin not extended behind the base, distant from the bases of the ventrals three times its length, in front of a serrated spine. Ventrals short, broader than long, angles rounded, hind margin slightly convex. Pectorals little wider than long, not falciform. Narial flap short, broad, little blunted at the angles, fringed at the teeth. Tail more than one and two thirds times the length of the disk.

Back brown; white below.

Central America; Rio Grande do Sul, Brazil.

Myliobatis aquila.

Plate **73**, fig. 1.

Aquila marina Belon, 1553, Aquat., p. 96, fig.
Aquila Salviani, 1554, Aquat., f. 147, pl. 50; Jonst., 1649, Pisc., p. 33, pl. 9, f. 8, 9; Willughby, 1686, Pisc., p. 64, pl. C. 2.
Pastinaca marina Matthioli, 1565, Comment., p. 325.
Raia sp. Artedi, 1738, Ichthyologia, Syn., p. 100, Gen., p. 72, no. 5.
Raia aquila Linné, 1758, Syst. nat., **1**, p. 232; 1766, Syst. nat., **1**, p. 396; Bonnaterre, 1788, Ichth., p. 4, pl. 4, f. 10; Gmelin, 1789, Linné Syst., **1**, p. 1508; Schneider, 1801, Bloch Ichth., p. 360; Risso, 1810, Ichth. Nice, p. 9.
La mourine Duhamel, 1782, Traite, **4**, p. 283, pl. 10.
Myliobatis aquila Cuv. 1817, Reg. anim., **2**, p. 137; 1829, ibid., p. 401; Risso, 1826, Hist. nat., **3**, Poissons, p. 162; Müller & Henle, 1841, Plagios., p. 176; Lowe, 1844, Fishes Madeira, pl. 15; Duméril, 1865, Elasm., p. 634; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 489; Moreau, 1881, Poiss. France, **1**, p. 442; Day, 1884, Brit. fishes, **2**, p. 352, pl. 176.
Whip ray Yarrell, 1836, Brit. fishes, **2**, p. 445; Couch, 1867, Brit. fishes, **1**, p. 135, pl. 32.
Myliobatis noctula Bonaparte, 1841, Icon. Fauna Ital., Pesci, fig.; Canestrini, 1872, Ital. pesci, p. 60.
Pastinaca aquila Gray, 1854, Gron. syst., p. 12.

Width of disk nearly one half its length, to ends of ventral fins, more than one third of the total length, or length of disk about two thirds of the width, in a specimen about twenty-nine inches in entire length. Snout broadly rounded, tip slightly produced; continuation of pectorals along the sides of the head into the rostral fins distinct, with rays as long as the eye or longer, Plate **73**, fig. 1. Spiracles large, twice as long as the eyes, hardly visible from directly above. Median upper teeth about four times, and lower about three times as wide as

long, width greater with age. No horn above the orbit. Pectorals nearly equilateral triangles; anterior margin somewhat convex, posterior concave; outer angle narrowly rounded, hinder acute. Ventrals rather short and broad, with about half of the outer margin extended behind the pectorals. Dorsal small one length of its base behind the ends of the ventrals or nearly three lengths behind their bases. Tail about twice as long as the body, with a serrated spine behind the dorsal. Skin smooth.

Back brown; dingy white below, brownish toward the edges.

Mediterranean and neighboring Atlantic.

Myliobatis freminvillii.

Plate **35**; Plate **39**, fig. 2; Plate **54**, fig. 3.

(?) *Raja bonasus* Mitch., 1815, N. Y. lit. & philos. trans., **1**, p. 479.
Myliobatis freminvillii Lesueur, 1824, Journ. Acad. nat. sci. Phil., **4**, p. 111; Jordan & Gilbert, 1882, Bull. 16, U. S. nat. mus., p. 51; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 89.
Myliobatis bispinosus Storer, 1842, Proc. Bost. soc. nat. hist., **1**, p. 53; Journ. Bost. soc. nat. hist., **4**, p. 188; Ayres, 1843, Journ. Bost. soc. nat. hist., **4**, p. 290; Duméril, 1865, Elasm., p. 637.
Myliobatis acuta Ayres, 1842, Proc. Bost. soc. nat. hist., **1**, p. 65; Linsley, 1844, Amer. journ. sci., **47**, p. 79; Storer, 1846, Mem. Amer. acad., new ser., **2**, p. 514; 1867, Mass. fishes, p. 269.

Width of disk less than twice its length. Snout narrowing forward, rather pointed; rostral fins connected at the side of the head with the pectorals by rays as long as the eye. Skull broad, rounded anteriorly, deeply concave in front of the foramen; foramen narrow and rounded backward, broad in front. Teeth in seven rows, in outer three as wide as long, in median row three or more times as wide as long. Anterior nasal valves confluent in a wide flap, rounded at the angles, free and slightly fringed on the hind margin. Length and width of pectorals about equal, outer extremity pointed, curved, anterior margin little convex, posterior concave, hind angles not elongate. Ventrals as broad as long, hind angles and margins rounded. Dorsal moderate, rounded above, highest in the middle, hind angle produced, origin distant from the bases of the ventrals one and one half lengths of the fin. Tail slender, more than twice the length of the body from snout to vent, with a serrated spine behind the dorsal. A horn above the orbit of the male.

Back and tail brown; lower surfaces white, darkening toward the outer margins.

Cape Cod; New York; Brazil.

Myliobatis tobijei.

Myliobatis aquila Schlegel, 1850, Jap. Pisces, p. 310, pl. 142.
Myliobatis tobijei Bleeker, 1857, Verh. Bat. gen., **26**, p. 130; Jordan & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 663.
Myliobatis cornuta Günth., 1870, Cat. fishes Brit. mus., **8**, p. 490.

Disk less than twice as wide as long, outer angles blunt, rounded, less blunt than those of *M. californicus;* anterior margin slightly convex, posterior slightly concave, margin behind the base of the pectoral convex, hind angle blunt. Rostral fins produced, broad, blunt, narrow at the sides of the head. Tip of snout little prominent. Teeth in median row four to five times as wide as long, wider in the older individuals. Dorsal small, rounded above, origin about one and one half times the length of the base behind the ends of the bases of the ventrals. Ventrals short, broad, rounded on the angles and the hind margin. Pectorals nearly as broad as long, not falciform. Skin smooth. Tail long. A horn above the orbit of males.

Color light brown; young with many spots of lighter or reddish, more distinct backward; old specimens uniform. Lower surfaces whitish.

Japan.

Myliobatis tenuicaudatus.

Myliobatis tenuicaudatus Hector, 1877, Trans. N. Z. inst., **9**, p. 468, pl. 10; Waite, 1907, Rec. Canterb. mus., **1**, p. 9.
Myliobatis australis Macleay, 1881, Proc. Linn. soc. N. S. W., **6**, p. 380; McCoy, 1882, Zool. Vict., **7**, pl. 63; Waite, 1899, Mem. Austr. mus., **4**, p. 47; 1904, Mem. N. S. Wales nat. club, no. 2, p. 11.

Width of disk less than twice the length; rostral fins continuous with the pectorals, nearly as wide at the side of the head as in front. Tip of snout not produced. Median teeth of lower jaw four times as wide as long, of upper jaw six times, or more. Pectorals hardly as wide as long, outer extremities moderately sharp, anterior margin nearly straight, posterior concave.

Ventrals short, broad, subtruncate, inner rays rather longer than outer. Origin of dorsal nearly opposite the ends of the bases of the ventrals, about two thirds of the fin behind their tips. A serrated spine behind the dorsal.

The type measured nineteen inches from snout to vent and thirty-six inches across the disk.

Dark brown with blue bars; white beneath. In cases apparently the bars are represented by spots, or are obsolete.

If dissection proves there are no rays at the sides of the head, connecting the

pectoral with the rostral fins, as may be probable, this species will have to be placed in the genus Pteromylaeus.

Australia; New Zealand.

Myliobatis rhombus.

Myliobatis rhombus Basilewsky, 1855, Nouv. mém., **10**, p. 250.

"Discus rhomboideus, subtus albescens, supra fuscus, pinnis pectoralibus carnosis, valde dilatatis antrorsus in apicem acuminatum prominentem conjunctis circumductus. Pinna dorsalis nulla; subcaudales duae, carnosae, latae, discum postrorsum terminantes. Caput truncatum cum pectore dilatato sursum prominens, et pinnis pectoralibus circumductum. Os subtus apertum, transversum, magna maxilla inferiore hominis labii adinstar formata. Utraque maxilla dentibus tetragonis, planis, latis, lapideis, invicem stricte imbricatis obducta. Branchiarum aperturae ante os positae. Cauda disci longitudinae, attenuata, filiformis, aspera, tuberculis acutis obtecta. Latitudo disci 1 pes 7 pollices. Longit. ejus excepta cauda 1 pes 8 poll. caudae 1 pes et 6 poll. Habitat in Mare orientali et meridiano. Pekinum rarissime apportatur."

Basilewsky's description does not supply details enough for a proper determination of this species.

Aetomylaeus.

Aetomylaeus Garman, 1908, Bull. M. C. Z., **51**, p. 252.

The typical species of this genus was described by Gray, 1834, under the name *Myliobatis maculatus*. In the form of head and disk all the members of this genus resemble the species of Myliobatis; they are distinguished by the rostral fins, which are not continuous with the pectorals at the side of the head, but are situated at a lower level, and by the absence of a caudal spine. The dentition consists of three lateral rows of quite narrow teeth at each side of a median row of broad ones.

Origin of dorsal behind ends of bases of ventrals
  back armed in the middle with small spines or tubercles
    disk less than twice as broad as long
      brown-edged ocelli on hind part of disk . *maculatus* (page 435)
Origin of dorsal opposite ends of ventral bases
  back smooth
    disk less than twice as broad as long
      green brown-edged ocelli on hind part of disk *milvus* (page 435)

disk twice as broad as long

blue cross-bands, ca. 5, disappearing with age *nichofii* (page 436)

Origin of dorsal behind ends of ventral bases

back smooth

disk less than twice as broad as long

brownish with a net-work of black, anteriorly in bands *vespertilio* (page 437)

Aetomylaeus maculatus.

Plate **36**, fig. 1–3; Plate **73**, fig. 3 (skeleton).

Myliobatis maculatus Gray & Hardwicke, 1834, Ill. Ind. zool., **2**, pl. 101; Müller & Henle, 1841, Plagios., p. 178; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 84; Duméril, 1865, Elasm., p. 639; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 490; Annandale, 1909, Mem. Ind. mus., **2**, p. 53.
Aetomylaeus maculatus Garman, 1908, Bull. M. C. Z., **51**, p. 252.

Width of disk about twice the distance from snout to vent. Pectorals as long as wide, outer ends curved, acute, anterior margin convex, posterior concave. Head broad, convex transversely, angles rounded, concave in front of the fontanel. Fontanel broad, wide and rounded at the hinder end. Snout (rostral fins) bluntly pointed, narrower than the skull, not connected by rays along the side of the head with the pectorals. Eye moderate, pupil erect. Spiracles large, hardly visible from above. Teeth in the median row five to six times as broad as long. Ventrals longer than broad, inner margin short, hinder oblique, angles rounded. Dorsal small, rounded above, hind margin nearly vertical, a short free margin behind the base ends in a right angle, origin little behind the ends of the bases of the ventrals. Tail more than four times as long as the body. A specimen of about twenty-seven inches in length measures $8\frac{1}{2}$ in width, $4\frac{3}{4}$ from snout to vent and $22\frac{1}{2}$ inches from vent to end of tail. Skin rough with small tubercles or spines, in a dorsal area on the young. No horn on the orbit. No caudal spine.

Back brown with dark-edged rounded spots of whitish posteriorly; white below; tail indistinctly banded with brown and darker.

Indian Seas; East Indies; Penang.

Aetomylaeus milvus.

Myliobatis milvus Müller & Henle, 1841, Plagios., p. 178; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 87; Duméril, 1865, Elasm., p. 638; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 491.
Myliobatis vultur Müller & Henle, 1841, Plagios., p. 179; Duméril, 1865, Elasm., p. 640.
Myliobatis oculeus Richardson, 1846, Rept. Brit. assoc. adv. sci. for 1845, p. 198.
Aetomylaeus milvus Garman, 1908, Bull. M. C. Z., **51**, p. 253.

Width of disk nearly twice the distance from snout to vent, anterior margins convex, posterior concave, outer angles acute. Snout two to three times as long as the nasal valves, rounded in front. Skull broad, depressed, subtruncate; fontanel rather narrow, tapering moderately backward, rounded behind. Anterior nasal valves confluent in a broad flap, free in front of the teeth, rounded at the angles, fringed on the hinder margin, with a slight notch in the middle. Median row of teeth four to five times as broad as long. Rostral fins rather small, not continuous with the pectorals, narrowing forward, rounded at end of snout. Length of ventrals more than twice the width, outer angle rounded, hind margin broadly rounded from inner end of base to outer angle. Dorsal subtriangular, highest in the middle, posterior border nearly straight, oblique; fin longest on the base, end little behind the ends of the ventrals, origin above ends of ventral bases, little or no free margin behind the end of the base. Snout to mouth cleft equal twice the distance between the nostrils.

A specimen from Hong Kong measures $14\frac{1}{2}$ inches across the disk and $7\frac{1}{2}$ inches from snout to vent. No horn on the orbit. No caudal spine. Tail about four times the length of the disk.

Back brown, greenish or bronzed in life, with whitish spots over the disk, in cases fused into narrow transverse bands.

Red Sea; China; East Indies.

Aetomylaeus nichofii.

Zee-vleermuis Nieuhof, 1682, Gedenk. reize., **1**, p. 278, fig.; Willughby, 1686, Pisc., p. 6, pl. 10, f. 3.
Raia nichofii Schneider, 1801, Bloch Ichth., p. 364 (*niehofii* p. 579).
Mookarah tenkee Russell, 1803, Coromandel fishes, **1**, p. 4; pl. 7.
Raia fasciata Shaw, 1804, Zool., **5**, p. 286, pl. 143.
Aetobatus nichofii Blainv., 1816, Bull. Soc. philom., p. 112.
Myliobatis nieuhowii Cuv., 1817, Reg. anim., **2**, p. 138.
Myliobatis nieuhofii Müller & Henle, 1841, Plagios., p. 117; T. Cantor, 1849, Malay. fishes, p. 432; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 85; Duméril, 1865, Elasm., p. 638; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 491; Jord. & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 604; Annandale, 1909, Mem. Ind. mus., **2**, p. 51.
Aetomylaeus nichofii Garman, 1908, Bull. M. C. Z., **53**, p. 253.

Width of disk twice the length of the body. Distance from cleft of mouth to end of snout one and one half times the distance between the nostrils. Snout shorter than that of *A. milvus*, much less produced, tapering more rapidly. Rostral fins not continuous with the pectorals at the side of the head. On individuals of the same length, the snout of *A. nichofii* has about the same length as that of *Myliobatis aquila* but is much more pointed and lacks the flanges from rostral fins to pectorals. The width of each pectoral is little more than its

length, the outer angle is less sharp than on *A. milvus*, the tip is more rounded, and the hind angle is somewhat sharper. Ventrals about twice as long as wide, outer angle rounded, hind margin a broad curve from the outer angle to the end of the base. Dorsal small, with a short free inner margin behind the end of the base, one third of the base behind the ends of the ventrals, origin nearly opposite ends of ventral bases. Tail three times the length of the body, or more; no caudal spine. No orbital horn in most cases. Skin somewhat roughened in old specimens.

Back brown, with five or six narrow bands of lighter, bluish, disappearing with age; lower surfaces white outer margins of pectorals brownish.

India; East Indies; Japan.

Aetomylaeus vespertilio.

Myliobatis milvus T. Cantor, 1849, Malay. fishes, p. 433.
Myliobatis vespertilio Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 85; Duméril, 1865, Elas., p. 636; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 490.
Aetomylaeus vespertilio Garman, 1908, Bull. M. C. Z., **51**, p. 253.

Disk nearly twice as broad as long. Teeth in the middle row six times as broad as long; upper pavement as broad as long, lower longer than broad. Nasal valves confluent, flap with rounded angles, little notched in the middle. Pectorals convex in front, concave behind, acute in the outer angle. Dorsal origin behind the ends of the ventral bases, fin not extending to ends of the ventrals. No horn on the orbit. No caudal spine. Skin smooth. An individual measured had a width of 19, a length from snout to vent of $7\frac{5}{8}$, and a length of tail of $46\frac{1}{4}$ inches.

Fawn color, with anastomosing black lines arranged transversely on the anterior half of the disk so that the spaces between resemble broad transverse bands; elsewhere the lines form an open net-work; front margin of pectorals and dorsal without black meshes. Tail near the base brownish with faint rings of blackish, otherwise black. Ventral surfaces white.

Batavia; Penang.

Pteromylaeus.

This genus resembles Aëtobatus somewhat closely in general appearance and in structure but differs greatly in dentition. Compared with Myliobatis the head is more elongate, and more narrow forward and in the snout, the pectoral fins are more falciform and are not continuous with the rostral fins at

the side of the head, the ventrals are more elongate and narrow and the spiracles open more upward and less to the side. The teeth are tessellate, in seven rows:— a median row of very broad teeth at each side of which are three very narrow ones. The tail is long and slender; it bears a serrated spine behind the dorsal.

Origin of dorsal fin far behind bases of ventrals

back brown with transverse markings and spots of white

asperrimus (page 438)

Origin of dorsal above ends of ventral bases

back uniform brown . . . . . *bovina* (page 439)

Origin of dorsal near ends of pectoral bases

back greenish grey with irregularly distributed spots of white

punctatus (page 439)

Pteromylaeus asperrimus.

Myliobatis asperrimus Jord. & Everm., 1898, Bull. 47, U. S. nat. mus., p. 2754; Gilbert & Starks, 1904, Mem. Cal. acad. sci., **4**, p. 19, pl. 3, f. 6.

Disk nearly twice as broad as long, anterior margins convex, posterior concave, outer angles slightly blunted. Head prominent, crown transversely convex, narrowing toward the snout and the mouth. Snout produced, pointed; rostral fins not continuous with the pectorals, at a lower level, narrower than the cranium, forming a single flexible lobe. Skull prominent in the preorbital region, excavated in front of the fontanel. Anterior nasal valves confluent in a broad flap reaching the mouth, free at the lateral edges and behind, with a shallow notch in the middle. Spiracles large, twice the length of the eye, partly visible from above. Teeth in seven rows, median four to five times as broad as long, more or less fused, outer narrow. Ventrals moderate, longer than broad, rounded posteriorly, considerably extended behind the pectorals. Dorsal small, as long as the spiracle, rounded above and behind, origin about twice the basal length farther back than the bases of the ventrals. Tail slender, very long, more than three times the length of the body. On young individuals the caudal spine has a rudimentary appearance; it is situated at a distance behind the dorsal equal to about two lengths of that fin. Skin rough with small spines.

Measurements of an immature specimen from Panama are as follows:— length of disk 19, length of tail $59\frac{1}{2}$, and width of disk 31 inches.

Back brown, ashy or greyish, crossed by stripes of white, fainter anteriorly, and farther back giving place to numerous spots of irregular sizes and shapes, as large as the eye to very small. In cases the edges of snout, disk, and dorsal, and the tail are black.

Pteromylaeus bovina.

Myliobatis bovina Geoffroy Saint-Hilaire, 1827, Descript. Egypt, **1**, p. 323, pl. 26, f. 1; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 490; Moreau, 1881, Poiss. France, **1**, p. 446.
Myliobates aquila Müller, 1835, Anat. Myxin., **1**, pl. 9, f. 13.
Myliobatis aquila Bonaparte, 1841, Icon. Fauna Ital., Pesci; Lowe, 1844, Fishes Madeira, pl. 15; Canestrini, 1872, Ital. pesci, p. 60.
Myliobatis episcopus Valenciennes, 1843, Ichth. Canar., p. 98, pl. 24.
Myliobatis bonaparti Duméril, 1865, Elasm., p. 635.

Shape like that of Aëtobatus, but stouter. Disk about twice as wide as long. Head large, prominent; snout produced, narrower than the skull, blunted at the end. Rostral fins at a lower level and separated from the pectorals along the side of the head. Pectorals about as wide as long, front margin convex, hind margin concave outer angle acute, falciform. Anterior nasal valves confluent, free behind, somewhat notched in front of the teeth. Teeth in pavement, in seven rows. Median six to eight times as broad as long, outer narrow. Spiracle large hardly visible from above. Ventrals rather elongate, rounded behind. Dorsals small, rounded, origin close behind ends of ventral bases. Tail about three times as long as the disk. A serrated spine. No orbital horn. Skin rough on old individuals.

Back of adults brown; of younger brown with seven or eight, more or less indistinct, transverse stripes of whitish.

Mediterranean and neighboring Atlantic.

Pteromylaeus punctatus.

Myliobatis punctatus Maclay & Macleay, 1886, Proc. Linn. soc. N. S. W., **10**, p. 675, pl. 46, f. 1–6.
Aëtobatis punctata Günth., 1910, Südsee fische, **3**, p. 497.

Snout long, triangular, pointed; rostral fins not continuous with the pectorals. "The teeth plates of the upper jaw are nearly twice as wide as the lower (48 mm. the upper, 27 mm. the lower). These plates consist of many longitudinal rows of teeth, of which the middle rows are longest" [?widest]. "On the back of the mouth there are rows of papillae on the palate, seven in the first row and four in the second, there are similar but smaller papillae on the sides of the teeth of the lower jaw." Nasal valves united in a broad flap, acute angled and deeply notched in the middle. Eyes small, pupil vertical. Pectorals broad, falciform, acute on the outer angle, convex on the front margin, concave on the posterior. Dorsal origin near the ends of the pectoral bases, end of fin near the mid length of the ventral fins. Ventrals elongate, narrow. A serrated spine on the tail.

Width of disk 1,430, length from snout to ends of ventrals 1,130, and length of tail from the dorsal 640 mm.

Greenish grey with white spots of different sizes irregularly distributed; below dirty white darker on the pectorals.

Admiralty Islands.

Aëtobatus.

Aëtobatus Blainv., 1816, Bull. Soc. philom., p. 112.
Stoasodon T. Cantor, 1849, Malay. fishes, p. 434.

Pectorals slightly falciform, not continuous forward to the snout. Rostral fins separated from the pectorals and at a lower level on the sides of the head. Teeth in a single row on each jaw, fused, lower pavement produced. Head prominent, narrowing downward and forward on the sides; snout narrower, produced. Anterior nasal valves confluent; a median notch in the preoral flap. Ventrals narrow, elongate. Tail long, slender, bearing a dorsal fin and a serrated spine above the basal portion. As in some other genera several species so-called are described to complete the record, at the risk of ranking them too high. A larger series of specimens will no doubt reduce the number of species to one with one or more varieties.

Fossil species of this genus have been discovered by Agassiz and others in the Eocene and later formations. Mesobatis Leidy from the phosphate beds of South Carolina is intermediate between Aëtobatus and Pteromylaeus; it has small teeth between the ends of the broad ones.

Snout long tapering, acute
  uniform, or spotted with whitish . . . . *flagellum* (page 440)
Snout long, broadly rounded at the end
  spotted with white . . . . . *narinari* (page 441)
Snout short, tapering, blunt
  spotted thickly with small dark-edged spots . . *ocellatus* (page 442)

Aëtobatus flagellum.

Raia flagellum Schneider, 1801, Bloch Ichth., p. 361, pl. 73.
Raia guttata Shaw, 1804, Zool., **5**, p. 285, pl. 142.
Aëtobatus flagellum Müller & Henle, 1841, Plagios., p. 180; Blyth, 1860, Journ. Asiat. soc. Bengal, **29**, p. 37; Duméril, 1861, Arch. mus., **10**, p. 242, pl. 20, f. 3; 1865, Elasm., p. 642; Klunzinger, 1871, Syn. fische, **2**, p. 246; Annandale, 1909, Mem. Ind. mus., **2**, p. 57.
Goniobatis flagellum Agass., 1858, Proc. Bost. nat. hist., **6**, p. 385.

This species differs from other species of the genus in length and sharpness of snout, and in colors. The snout is longer than broad and tapers to a sharp

point. On the specimen figured by Schneider there were no spots; on that used in the present comparisons spots are present but scattered and not sharply defined; they approach closely to the conditions figured by Shaw in *Raia guttata*. The individual was taken at Mauritius; its measurements are length of body $11\frac{1}{2}$, of tail 38, and width of disk $21\frac{1}{2}$ inches. Skin smooth; tail rough in old specimens. A specimen of the uniform brown type like that figured by Schneider and Bloch is 38 inches wide and 23 inches in length from snout to ends of ventrals; the anterior margins of its pectorals are nearly straight, the posterior are concave in the outer half and convex on the inner, the outer angles are sharp, very little blunted, and the hind angles are broadly rounded; the origin of the dorsal is about one length of the base behind the ends of the ventral bases and the end of the fin is in front of the ends of the ventral fins.

Red Sea; Indian Ocean.

AËTOBATUS NARINARI.

Plate **49**, fig. 1–3 (teeth); Plate **54**, fig. 4 (pelvis); Plate **55**, fig. 9 (vertebrae); Plate **57**, fig. 4 (heart); Plate **73**, fig. 4 (skeleton).

Narinari brasiliensibus MARCGRAVE, 1648, Hist. nat. Brasil., p. 175, fig.; WILLUGHBY, 1686, Pisc., p. 66, pl. C1, f. 5.

Whip-ray BROOKES, 1763, Nat. hist., **3**, Fishes, p. 36.

Raia narinari EUPHRASEN, 1790, Kongl. sven. vet. akad. Nya handl., **11**, p. 217, pl. 10; SCHNEIDER, 1801, Bloch Ichth., p. 361.

Aëtobatus narinari BLAINV., 1816, Bull. Soc. philom., p. 112; MÜLLER & HENLE, 1841, Plagios., p. 179; AGASS., 1843, Rech. poiss. foss., **3**, p. 325; 1833, Atlas, pl. D, f. 1, 2; DUMÉRIL, 1865, Elasm., p. 641; GÜNTH., 1870, Cat. fishes Brit. mus., **8**, p. 492 (part); JORDAN & GILBERT, 1882, Bull. 16, U. S. nat. mus., p. 50; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 88; 1900, ibid., Atlas, pl. 15, 16; EVERM. & MARSH, 1902, Bull. U. S. fish comm., **20**, p. 67, fig. 4, 5; COLES, 1910, Bull. Amer. mus. nat. hist., **28**, p. 338.

Myliobatis narinari CUV., 1817, Reg. anim., **2**, p. 138.

Raia quinquemaculata QUOY et GAIMARD, 1824, Voy. Uran. Poiss., p. 200, pl. 43, f. 3.

Aetobatis latirostris DUMÉRIL, 1861, Arch. mus., **10**, p. 242, pl. 20, f. 1; 1865, Elasm., p. 643; GÜNTH., 1866, Trans. Zool. soc. London, **6**, p. 491.

Aetobatus laticeps GILL, 1865, Ann. N. Y. lyc., **8**, p. 137.

Stoasodon narinari JORDAN & GILBERT, 1882, Bull. 16, U. S. nat. mus., p. 879.

Stoasodon laticeps JORDAN & GILBERT, 1882, Bull. 16, U. S. nat. mus., p. 879.

Width of the disk nearly twice the length; anterior borders convex, posterior concave. Pectorals somewhat falciform, acute on the outer angle. Rostral fins distinct from the pectorals, joined in a single produced, depressed, and pointed lobe. Cranium large, narrower toward the mouth, convex across the crown. Teeth in a single row on each jaw, broad and short, fused, upper wider; lower pavement flatter and more produced. Each tooth is curved or angled forward more or less in the middle, the amount varying in the individual. Eyes prominent. Spiracles large, lateral, behind the eyes, partly visible from above.

Ventrals narrow, elongate, nearly half extended behind the ends of the pectorals, rounded posteriorly. Dorsal small, rounded above, with a short free margin and an angle behind the base, origin above the ends of the bases of the ventrals. Tail whip-like, very slender, more than four times the length of the body. In a specimen at hand the measurements are from snout to vent 13, from vent to end of tail 59, and across the pectorals 25 inches.

Brown with spots of bluish white scattered over the back, fainter on the head and the forward part of the disk, white beneath; tail dark.

Tropical and temperate parts of the Atlantic and the Eastern Pacific.

Aëtobatus ocellatus.

Raia ocellata Russell, 1803, Coromandel fishes, **2**, p. 5, pl. 8.
Eel tenkee Russell, 1803, Coromandel fishes, **2**, p. 5, pl. 8.
Myliobatis eeltenkee Rüppell, 1835, Neue wirb. Abyssinien, Fische, p. 70, pl. 19, f. 3.
Aetobatis indica Swainson, 1839, Class., **2**, p. 321.
Myliobatis macroptera McClellan, 1841, Calcutta journ. nat. hist., **1**, p. 60, pl. 2, f. 1.
Stoasodon narinari T. Cantor, 1849, Malay fishes, p. 434.
Aetobatis narinari Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 87; Day, 1865, Fishes Malabar, p. 280; 1878, Ind. fishes, p. 743, pl. 194, f. 4; Klunzinger, 1871, Syn. fische, **2**, p. 245.
Aetobatis guttata Annandale, 1909, Mem. Ind. mus., **2**, p. 56.

Shaped like *A. narinari* and *A. flagellum*, but deeper in the body and head and more convex on the crown. Disk nearly twice as wide as long; outer angle of the pectorals acute, hinder broadly rounded; anterior margins nearly straight, posterior concave. As in the other Aëtobati the anterior nasal valves are confluent, deeply notched, and not free behind their point of junction; each valve has a thin transverse lobe above the outer edge extending inward and forming the partition in the nostril; and each posterior valve is a thin fold from the outer edge of the nostril reaching downward behind the outer half of the nasal cavity. Ventrals longer than wide, free portion subquadrate, with angles rounded. Dorsal small, origin above ends of ventral bases, upper and hind margins convex. Tail nearly four times the length of the body, from snout to abdominal pores. Skin with a slight roughness.

Ashy brown, greenish in life, with numerous dark-edged small spots of white thickly scattered over the back; lower surfaces white; tail dark.

A specimen used for comparison has a width of $22\frac{1}{2}$, a body length, from snout to pores, of $11\frac{1}{2}$, and a length of tail of 45 inches. In shapes proportions and colors it approaches very close to that figured by Russell. The spots are rather more numerous forward.

Indian Ocean.

Rhinopteridae.

Body, head, and pectorals united in a broad lozenge-shaped disk in which the development of the pectorals is greater in the anterior half. A pair of rostral fins, not joined in front of the skull and not continuous at the sides of the head with the pectorals. Teeth broad, angular, flat, in pavement, median series broadest in most species. Eyes prominent, lateral. Spiracles large, behind the eyes, opening laterally. Cranium prominent. Tail long, slender, whip-like, with a dorsal fin above the basal portion and with a serrated spine farther back.

Rhinoptera.

Rhinoptera Voigt, 1832, Thierreich, **2**, p. 525.
Zygobatis Agass., 1838, Rech. poiss. foss., **3**, p. 79.
Rhinoptera Gill, 1865, Ann. N. Y. lyc., **8**, p. 136.
Mylorhina Gill, 1865, Ann. N. Y. lyc., **8**, p. 136.
Micromesus Gill, 1865, Ann. N. Y. lyc., **8**, p. 136.

Disk broad; head moderately prominent. Pectorals not continuous along the sides of the head to the snout. Rostral fins detached from the pectorals, forming a produced, free and flexible lobe in front of each orbit, not produced in front of the middle of the head. Anterior nasal valves confluent in a broad flap, free behind and at the sides. Skull broad, subtruncate, depressed to a rather sharp edge in front of each eye, deeply notched at the fontanel. Eye round, pupil erect. Tail long, slender, with dorsal fin and a serrated spine above the basal portion. Teeth tessellated, angular, in five or more rows, 5–19, median commonly wider.

Tropical and temperate seas.

Fossil species of the genus have been recorded from the Lower Eocene, the Miocene, and the Pliocene.

Teeth in seven rows; skin smooth

median teeth 5–7 times as wide as long, next row $2\frac{1}{2}$, others decreasing in width regularly . . . . . *quadriloba* (page 444)

median teeth 3–6 times as wide as long, next outer 2–3, outer two rows at each side as wide as long . . . . *lalandii* (page 445)

median teeth 3–5 times as wide as long, next outer half as wide, outer two rows at each side as wide as long . . *javanica* (page 446)

median teeth 3 times and next outer 2 times as wide as long, outer rows narrower . . . . . *steindachneri* (page 446)

Teeth in nine rows on the upper jaw; seven on the lower
median row nearly three times and next rows one and one half times as wide as long, second from median narrow, outer narrowest *marginata* (page 445)
median row and second on each side of it 3 times as wide as long, narrower than row at each side of median . . *adspersa* (page 447)
median three rows 5–7 times as wide as long, others narrower *jussieui* (page 447)
median row 8 times as wide as long, next row 4 times *jayakari* (page 448)
median three rows and outermost rows 2–3 times as wide as long *peli* (page 448)
Teeth on upper jaw in 15 rows, on lower jaw 19, abnormal *polyodon* (page 448)
Teeth on lower jaw in 14 rows, abnormal . . . *encenadae* (page 448)

Rhinoptera quadriloba.

Plate **37**, fig. 1–5.

Raia quadriloba Lesueur, 1817, Journ. Acad. nat. sci. Phil., **1**, p. 44, pl.
Myliobatis quadriloba Cuv., 1829, Reg. anim., **2**, p. 401.
Rhinoptera quadriloba Voigt, 1832, Thierreich, **2**, p. 525; DeKay, 1842, N. Y. fish., p. 375, pl. 66, f. 217; Duméril, 1865, Elasm., p. 648; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 494; Jordan & Gilbert, 1883, Bull. 16, U. S. nat. mus., p. 51.
Rhinoptera bonasus Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 90.

Disk broad, length including ventrals and head about equal to seven tenths of the width. Head short, as broad as long, deeply indented in front of the fontanel and between the rostral fins. Teeth in seven rows: — median upper about five times as wide as long, next row half and second row one fourth as wide as the median, outer row as wide as long. Median lower four fifths as wide as the upper, outward rows decreasing in width like the upper. The pavement is less convex transversely than that of *R. lalandii*, and is more arched than that of *R. jussieui*. Pectorals longer than wide, outer angle acute, tip slightly falciform, hind angle blunt. Ventrals narrow, more than half as wide as long, hind margin convex, slightly oblique, inward rays somewhat longer. Dorsal origin little behind ends of ventral bases, upper margin straight, upper angle blunted; hind angle produced in a sharp point not extending quite as far back as the ends of the ventral fins. Skin smooth. Tail less than twice as long as the disk.

The specimen described was secured by Mr. Samuel Powel, at Newport,

Rhode Island; it was twenty-two inches in width and fourteen in length from snout to ends of ventrals.

Back and tail brown; lower surfaces white, brownish toward outer angles of pectorals.

Rhinoptera lalandii.

Plate **48**, fig. 5–6 (teeth).

Rhinoptera lalandii Müller & Henle, 1841, Plagios., p. 182; Duméril, 1865, Elasm., p. 648; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 494; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 193.
Mylorhina lalandii Gill, 1865, Ann. N. Y. lyc., **8**, p. 136.

Width of disk about twice its length, little less than the length of the tail. Head wider than long, moderately notched in front of the fontanel and between the rostral fins. Anterior narial valves confluent in a broad flap reaching the mouth, straight and fringed on the edge, free and wider backward with angles nearly acute. Teeth in seven rows, in cases five in the upper jaw: — a median row of teeth three to six times as wide as long, a lateral row at each side of it in which the width is from two to three times the length, and an outer two rows in which width and length are about equal. Pectorals with length and width nearly equal, outer angle acute, narrowly rounded at the tip. Ventrals more than half as broad as long, convex on the end. Dorsal subtriangular, margins nearly straight; upper angle rounded, posterior little produced; origin opposite ends of ventral bases; tip not as far back as tips of ventrals. Skin smooth. Specimen at hand measures as follows: — width $20\frac{1}{2}$, snout to vent $10\frac{1}{2}$ and vent to end of tail 23 inches.

Back brown; beneath white, brownish on outer portions of pectorals.

Off eastern coasts of South America.

Rhinoptera marginata.

Plate **48**, fig. 4 (teeth).

Myliobatis marginata Geoffroy Saint-Hilaire, 1827, Descript. Egypt, **1**, p. 334, pl. 25, f. 3, 4.
Rhinoptera marginata Cuv., 1829, Reg. anim., **2**, p. 401: Voigt, 1832, Thierreich, **2**, p. 525; Müller & Henle, 1841, Plagios., p. 181; Duméril, 1865, Elasm., p. 645; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 493.
Myliobatis (*Rhinoptera*) *marginata* Owen, 1845, Odont., p. 46, pl. 25, f. 2, 3.

Disk about twice as broad as long; anterior margin convex, nearly straight, posterior concave. Pectoral slightly falciform; outer angle blunted, hinder sharp. Teeth in nine rows; median row nearly three times as wide as long,

next rows about half as wide, and the third at each side little broader than long; outer teeth narrowest, pentagonal. Ventrals longer than wide, with angles rounded, subtruncate. Dorsal between the ventrals, origin above ends of ventral bases, rounded above, with a short free margin and a slightly produced angle behind the base. Tail nearly twice the length of the disk, with a spine behind the dorsal. Skin smooth.

Back brown, greenish, and bronzed; lower surfaces white. In life more or less tinted with red.

Mediterranean.

Rhinoptera steindachneri.

Rhinoptera steindachneri Evermann & Jenkins, 1891, Proc. U. S. nat. mus., **14**, p. 130, pl. 1, f. 1.

Width of disk nearly twice its length. Pectorals little longer than wide, outer angle acute, apex narrowly rounded, hind angle more broadly rounded. Teeth in seven rows: — median row nearly three times and the next one to it nearly twice as wide as long. Ventrals narrow, elongate, posterior border convex. Dorsal rounded above, hind angle slightly produced beyond the base, origin behind the ends of the pectoral bases, tip not reaching to ends of ventral bases. Tail longer than the disk. Skin smooth.

Uniform dark brown; white below.

Gulf of California.

Rhinoptera javanica.

Rhinoptera javanica Müller & Henle, 1841, Plagios., p. 182; Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 89; Duméril, 1865, Elasm., p. 647; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 494; Day, 1878, Ind. fishes, p. 744, pl. 195, f. 4.
Rhinoptera affinis Bleeker, 1862, Nat. verh. Holl. maatsch. wetensch., p. 19.

Proportions similar to those of *R. marginata*. Disk less than twice as broad as long; tail nearly twice the length of the disk. A shallow notch in front of the snout. Teeth in seven rows, those in median row three to five times as wide as long, those in the two next rows about half as wide as the median, and those in the outer two rows on each side as wide as long; median rows narrower on lower jaws. Dorsal origin above the ends of the ventral bases. Skin smooth.

Blackish green; ventral surface white.

Java; India.

Rhinoptera adspersa.

Rhinoptera adspersa Müller & Henle, 1841, Plagios., p. 183; Jerdon, 1851, Madras journ., p. 149; Duméril, 1865, Elasm., p. 648; Günth., 1870, Cat. fishes Brit. mus., **8**, p 494; Day, 1878, Ind. fishes, p. 744.
Micromesus adspersus Gill, 1865, Ann. N. Y. lyc., **8**, p. 136 (name only).

Snout broad and proportionately short. Upper teeth in nine rows, middle row and second on each side of it about equal, each of teeth less than three times as broad as long, narrower than the rows separating them. Lower teeth in seven rows, middle row wider, other rows narrowing to the outer. Disk about twice as wide as long. Tail more than three times the length of the disk. Dorsal origin little behind base of ventrals. Back rough with small stellate-based spines.

Greenish brown, lighter below.

Indian Ocean.

Rhinoptera jussieui.

Plate **48**, fig. 1–3 (teeth); Plate **54**, fig. 5 (pelvis); Plate **55**, fig. 10 (vertebrae); Plate **57**, fig. 5 (heart); Plate **59**, fig. 9 (gills); Plate **74**, fig. 1–3 (skeleton).

Myliobatis jussieui Cuv., 1829, Reg. anim., **2**, p. 401; Voigt, 1832, Thierreich, **2**, p. 524.
Rhinoptera brasiliensis Müller, 1835, Anat. Myxin., p. 173, 276, pl. 9, f. 12; Müller & Henle, 1841, Plagios., p. 182; Duméril, 1865, Elasm., p. 646; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 646.
Zygobatis jussieui Agass., 1843, Rech. poiss. foss., **3**, p. 328, Tab. D, fig. 8.
Rhinoptera jussieui Günth., 1870, Cat. fishes Brit. mus., **8**, p. 493; Ribeiro, 1907, Arch. Mus. nac., **14**, p. 193, pl. 20.

Disk hardly twice as broad as long; tail little if any more than twice as long as the body. Head moderately notched in front of the fontanel and between the rostral fins. Pectorals about as wide as long, anterior margin nearly straight, outer angle acute and apex narrowly rounded, hind margin slightly concave, hind angle rounded. Ventrals narrower than long, obliquely subtruncate. Dorsal rounded above, hind angle produced, origin above ends of bases of ventrals, tip even with the tips of the latter. Teeth in nine rows (7–10): — three median of wide teeth, next outward in most cases about twice as wide as long and in the outermost one two or three rows the width equals the length. The variability in individuals of this species is excessive; the three wide rows and the flatness of the pavement serve to distinguish even such as have less than nine rows from those of *R. lalandii*. Skin smooth.

Dark brown on back and tail; white beneath, little darker below ends of pectorals.

Brazil.

Rhinoptera jayakari.

Rhinoptera jayakari Boulenger, 1895, Ann. mag. nat. hist., ser. 6, **15**, p. 141.

Width of the disk one and three fourths times its length. Head as broad as long; snout emarginate. Tail two fifths of the total length. Teeth in nine rows; those in the median row of the upper jaw eight times as broad as long, nearly twice the width of those in the next rows. In those of the median row of the lower jaw the width equals six times the length and is one and one half times the width of those in the next row at each side. Total length 740, length of disk 450, and width of disk 750 mm.

Blackish above; whitish beneath.

Muscat.

Rhinoptera peli.

Rhinoptera peli Bleeker, 1862, Nat. verh. Holl. maatsch. wetens., l. c., p. 18, pl. 1; Duméril, 1865, Elasm., p. 647.

Teeth in nine rows, hexagonal, those in middle row three times as wide as long; two rows of the outer teeth in the lower jaw and three rows of those in the upper jaw as broad as long. Dorsal origin hardly behind the ends of the ventral bases, end of fin slightly behind the ends of the ventral fins. Tail more than twice the length of the body. Skin smooth.

West Africa.

Rhinoptera polyodon.

Rhinoptera polyodon Günth., 1870, Cat. fishes Brit. mus., **8**, p. 495, fig.

Fifteen rows of hexangular teeth in the upper jaw, those in the five middle rows little broader than the outer ones. Lower teeth in nineteen rows, the median row and the outer one on each side nearly twice as broad as the others. Originally described from a pair of jaws of unknown origin.

Rhinoptera encenadae.

Rhinoptera encenadae Smith, 1886, Proc. U. S. nat. mus., **9**, p. 220; Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 91.

Named from an abnormal lower jaw, with fourteen rows of teeth unlike on the two sides, from Todos Santos Bay, Lower California.

Mobulidae.

Head, body, and pectorals forming a subrhomboid disk, broader than long, in which the head is broad and flat and bears a cephalic fin, a separated section

of the pectoral, extended forward, as a horn-like process, from each side. Pectorals broad, triangular, not continuous at the side of the head, acute-angled laterally and posteriorly. Ventrals small, between the pectorals. A small subtriangular dorsal on the tail, above and between the ventrals. Tail slender, whip-like. Mouth large, transverse; teeth small, numerous, in pavement. Gill openings large. Eyes lateral. Spiracles moderate, behind the orbits.

Some of the gigantic members of this family are said to reach a width of twenty feet and a weight of more than four tons.

Mouth inferior
- cephalic fins directed forward and rolled outward
  - teeth on both jaws . . . . . *Mobula* (page 449)
  - teeth on the upper jaw only . . . . *Ceratobatis* (page 453)

Mouth anterior
- cephalic fins directed forward
  - teeth on the lower jaw only . . . . *Manta* (page 454)

Mobula.

Mobula Rafinesque, 1810, Ind. itt. Sic., p. 48, 61.
Cephalopterus Risso, 1810, Ichth. Nice, p. 14.
Dicerobatus Blainv., 1816, Bull. Soc. philom., p. 112.
Cephaloptera Duméril, 1865, Elasm., p. 650.
Mobula Duméril, 1865, Elasm., p. 650.

Head broad, flat, truncate; mouth wide inferior; internarial space wide; rostrum short, broad, sharp edged anteriorly; rostral fins moderate, distinct from the pectorals, directed forward and obliquely downward but rolled from below outward in a subcylindrical roll (much as figured in *Raia fabroniana* Lacépède, 1800, Poiss., **2**, p. 111, pl. 5, f. 1) when not in use. Teeth on both jaws small, numerous, in pavement. Tail slender whip-like, with or without a serrated spine; dorsal fin between the ventrals.

With a serrated caudal spine
- tail more than twice as long as body
  - teeth bands reaching angles of mouth . . *mobular* (page 450)
- tail thrice as long as body
  - teeth bands reaching the angles . . . *japanica* (page 450)

Without a serrated caudal spine
- tail one and one half times length of body
  - teeth bands nearly reaching the angles . *eregoodoo-tenkee* (page 451)

tail more than twice length of disk

teeth bands ending a short distance from angles *draco* (page 451)

Tail about as long as the disk

teeth bands two thirds width of mouth . . *kuhlii* (page 452)

tail much longer than the body

teeth bands occupying about half the cleft . *hypostoma* (page 453)

Mobula mobular.

?Squalus edentulus Brunnich, 1768, Ichthy. Massiliensis, p. 6.
Mobular Duhamel, 1782, Traité, **4**, p. 293, pl. 17.
Raia mobular Bonnaterre, 1788, Ichth., p. 5.
La raie mobular Lacépède, 1798, Poissons, **1**, p. 33, 151.
?Aodon cornu Lacépède, 1798; Poissons, **1**, p. 297, 300.
Raia fabroniana Lacépède, 1800, Poissons, **2**, p. 104, 111, pl. 5, f. 1.
Raia cephaloptera Schneider, 1801, Bloch Ichth., p. 365.
Raia giorna Lacépède, 1803, Poissons, **5**, p. 662, 666, pl. 20, f. 3.
Raia diabolus Shaw, 1804, Zool., **5**, p. 291.
Grande raia Giorna, 1805, Mem. Acad. sci. Turin, **2**, p. 4 extra.
Mobula auriculata Rafinesque, 1810, Indice, p. 48.
Apterurus fabroni Rafinesque, 1810, Indice, p. 48.
Cephalopterus giorna Risso, 1810, Ichth. Nice, p. 14; 1826, Hist. nat., **3**, Poissons, p. 163.
Cephalopterus massena Risso, 1810, Ichth. Nice, p. 15; 1826, Hist. nat., **3**, Poissons, p. 164.
Dicerobatus mobular Blainv., 1816, Bull. Soc. philom., p. 116; 1830, Poiss. Fr., p. 41.
Cephaloptera giorna Cuv., 1817, Reg. anim., p. 138; Risso, 1826, Hist. nat. **3**, Poissons, p. 163, pl. 5; Yarrell, 1836, Brit. fishes, **2**, p. 447; 1841, ibid., ed. 2, p. 595; 1859, ibid., ed. 3, p. 600; Müller & Henle, 1841, Plagios., p. 184; Valenciennes, 1843, Ichth. Canar., p. 97, pl. 22; Duméril, 1865, Elasm., p. 653; Rochebrune, 1882, Acta Soc. Linn. Bord., **36**, p. 57.
Cephaloptera Thompson, 1835, Proc. Zool. soc. London, p. 78.
Pterocephala fabroniana McCoy, 1847, Ann. mag. nat. hist., **19**, p. 176, pl. 11.
Cephaloptera fabroniana Duméril, 1865, Elasm., p. 658.
Dicerobatis giornae Günth., 1870, Cat. fishes Brit. mus., **8**, p. 496.

Disk about twice, or more than twice as wide as long; angles acute. Pectorals falciform, convex in front concave behind. Teeth minute, pointed, median more rounded, bands extending to the angles of the mouth, in 150 rows or more. Anterior portion of the base of the dorsal above the bases of the ventrals; extremities of the fins about even. Minute scales, shagreen, on the hinder portions of the body. Tail more than twice the length of the body, with a serrated spine behind the dorsal, rough with scales and tubercles.

Dark brown to blue-black above; white beneath.

Mediterranean and neighboring Atlantic.

Mobula japanica.

Cephaloptera japanica Müller & Henle, 1841, Plagios., p. 185; Schlegel, 1850, Jap. Pisces, p. 310; Duméril, 1865, Elasm. p. 659.
Dicerobatis japonica Günth., 1870, Cat. fishes Brit. mus., **8**, p. 496.
Mobula japonica Jordan & Fowler, 1903, Proc. U. S. nat. mus., **26**, p. 666, fig. 10.

Shape of disk similar to that of *M. kuhlii*. Body more than twice as broad as long. Tail nearly three times the length of the body. Teeth bands extending to the angles of the mouth; teeth minute blunt tubercles. Origin of the dorsal a little in advance of the beginnings of the ventrals; base extending as far backward as the ventral fins. Back rough, as in *M. mobular*. Tail rough, with a series of small white tubercles along each side.

Japan.

Mobula eregoodoo-tenkee.

Raja capito lato Russell, 1803, Coromandel fishes, **1**, p. 5, pl. 9.
Cephaloptera eregoodoo-tenkee Cuv., 1829, Reg. anim., **2**, p. 402; Bleeker, 1859, Enum., p. 214.
Dicerobatis eregoodoo T. Cantor, 1849, Malay. fishes, p. 438; Jerdon, 1851, Madras journ., lit. sci., **17**, p. 149; Günth., 1870, Cat. fishes Brit. mus., **8**, p. 497; Day, 1878, Ind. fishes, p. 744, pl. 193, f. 1; Lloyd, 1908, Rec. Ind. mus., **2**, p. 179, fig. 2, pl. 4, f. 1.
Cephaloptera eregoodoo Bleeker, 1852, Verh. Bat. gen., **24**, Plagios., p. 82; Duméril, 1865, Elasm., p. 655.
Dicerobatis monstrum Klunzinger, 1871, Syn., fische, **2**, p. 687.

Disk nearly twice as broad as long; angles acute, blunted. Tail slender, short, longer than the body in young, shorter in old, without a spine. Eyes prominent, pupil vertical. Teeth minute, pentagonal, with point directed into the cleft of the mouth, or with two or more points. The bands extend nearly to the angles. The teeth appear to vary greatly with age. Day states that they are small like flattened tubercles, as broad as long in adults, twice as broad in young. On jaws 12 inches across the gape, from a specimen 18 feet in width the rows were $\frac{340}{360}$, jaws of 4 inches in width $\frac{240}{244}$, and Cantor found the rows to be $\frac{80}{95}$ on the jaws of one 30 inches in width. The last specimen had a total length of about 45, from snout to vent $15\frac{1}{2}$, and a width of $30\frac{5}{8}$ inches. Dorsal between the ventrals, subtriangular, hind margin short, origin slightly in advance of the ventrals; in the figures published by Russell and by Day the end of the dorsal is some distance in front of the ends of the ventrals.

Young intense purple on the back, with ventral surfaces, sides of head behind the eyes, tip of dorsal, outer margins of ventrals, outer and lower surfaces of rostral fins, and tail to ends of ventrals white; jaws, margin of snout, and tail black.

Seas of India; Malay Archipelago; Red Sea.

Mobula draco.

Dicerobatis draco Günther, 1873, Cruise of H. M. S. Curaçoa, p. 412, pl. 26–27.

Teeth tessellated, those of the upper jaw in forty-six series, each tooth being broader than long and trenchant behind; the band of teeth terminates

laterally at a short distance from the angle of the mouth; body and tail smooth; the distance between the mouth and the dorsal fin is one half of the greatest width of the body; tail more than twice as long as the disk; upper parts uniform brown; top of the dorsal fin white. Greatest width of the disk fifteen inches; distance between the front margin of the head and dorsal fin seven and one third inches.

Mysol Island.

Anterior margin of snout and front margins of pectorals nearly straight; hind margins of disk concave, angles acute. Dorsal fin between the ventrals, but base and end extending little farther back than in those fins.

Mobula kuhlii.

Cephaloptera kuhlii Müller & Henle, 1841, Plagios., p. 185, pl. 59, f. 1; Bleeker, 1857, Act. Soc. sci. Ind. Neerl., **3**, p. 6; 1859, ibid., **6**, p. 214; Duméril, 1865, Elasm., p. 654.
Dicerobatis kuhlii Günth., 1870, Cat. fishes Brit. mus., **8**, p. 497; Day, 1878, Ind. fishes, p. 745.
Dicerobatis thurstoni Lloyd, 1908, Rec. Ind., mus., **2**, p. 179, fig. 3, pl. 4, f. 2.

Disk about twice as wide as long; anterior margins of the pectorals slightly convex, posterior concave, angles acute, narrowly rounded at the apex. Nasal valves confluent into a broad flap free at the nostrils and to a very slight extent in front of the teeth. Teeth bands occupying about two thirds of the width of the jaws, not extending to the angles of the mouth. As the teeth first appear, in the embryo, they are minute and widely separated; they resemble flattened tubercles; but as the later teeth appear in the same rows they enlarge rapidly, until broader than long and teeth and rows are in contact, tessellated. In cases it appears as if teeth had united thus decreasing the number of rows. The change from the minute, round, separate teeth to the broad teeth in close rows is made in a row of eight or ten teeth, all stages to be seen together on a single jaw. The appearance resembles that figured on Plates **48** and **49** for the beginnings of the rows of teeth on Rhinoptera, Myliobatus, and Aetobatis, though much more extensive; the resemblance is particularly noticeable in a comparison with fig. 1 of Plate **48**, *Rhinoptera jussieui*. The specimen described, $16\frac{1}{2}$ inches wide, has teeth in $\frac{44}{54}$ rows. Tail little longer than the disk, without a spine.

Origin of dorsal fin above end of vent, one fourth of the base above the bases of the ventrals, end of the base as far back as the ends of the same fins. Skin smooth, in young.

Dark brown above; white beneath.

Indian Ocean; East Indies; Japan.

Mobula hypostoma.

Plate **38**; Plate **54**, fig. 6 (pelvis); Plate **57**, fig. 6 (heart); Plate **59**, fig. 7–8 (gills); Plate **75** (skeleton).

Cephalopterus hypostomus Bancroft, 1831, Proc. Zool. soc. London, pt. 1, p. 134; 1834, Zool. journ. **5**, p. 411.
Cephaloptera olfersii Müller, 1834, Abh. Akad. wiss. Berlin, p. 311; 1835, Anat. Myxin., p. 12, 247; Müller & Henle, 1841, Plagios., p. 185; Duméril, 1865, Elasm., p. 657.
Dicerobatis olfersii Günth., 1870, Cat. fishes Brit. mus., **8**, p. 497.
Dicerobatus olfersii Garman, 1888, Bull. M. C. Z., **17**, p. 105, pl. 52, 53.
Aodon hypostomus Jord. & Everm., 1896, Bull. 47, U. S. nat. mus., p. 92.
Mobula olfersi Coles, 1910, Bull. Amer. mus. nat. hist., **28**, p. 341; Pellegrin, 1912, Bull. Soc. philom. ser. 10, **4**, p. 5 extra.

Irregular diamond shaped, nearly twice as wide as long, angles acute. Pectorals nearly straight in front, concave behind. Teeth small, broad, rounded or with one to several points on the inward edge, in $\frac{52}{46}$ rows on a specimen thirty-nine inches in width, Plate **38**, fig. 5 and 6. Müller and Henle give the number of rows on their specimen as about 80. Teeth bands occupying about half the width of the jaws. Tail longer than the body, without a spine. Back smooth, large individuals rough posteriorly on the body, and on the tail. Origin of dorsal fin little behind the vent; extremity little in front of the ends of the ventrals. Teeth increasing in the numbers of rows with age, and in width of bands.

Brown on the back; white beneath.

Brasil to New York.

Mobula rochebrunei.

Cephaloptera rochebrunei Vaillant, 1879, Bull. Soc. philom., p. 171; Rochebrune, 1882, Acta Soc. Linn. Bord., **36**, p. 58, pl. 1, f. 1–2.

According to the description and the figure this form agrees in all respects except coloration with *M. hypostoma*, of which it may be a variety.

Deep blue; with reddish on the frontal region, in a longitudinal band behind the head along the middle of the back, and on dorsal, ventrals, and tail. Rows of teeth 50, occupying about half the width of the jaws.

Off northwestern Africa.

Ceratobatis.

Ceratobatis Boulenger, 1897, Ann. mag. nat. hist., ser. 6, **20**, p. 227.

"Like *Dicerobatis* Blainv., but teeth restricted to the upper jaw."

A subgenus of Mobula.

Ceratobatis robertsii.

Ceratobatis robertsii Boulenger, 1897, Ann. mag. nat. hist., ser. 6, **20**, p. 227.

"The band of teeth occupying only half the width of the mouth, its width ten times in its length; teeth tessellated, hexagonal, two to three times broad as as long, rugose with numerous obtuse ridges. Mouth inferior, wide. Pupil vertically elliptic. Body smooth; pectoral fins with nearly straight, slightly convex anterior and slightly concave posterior border. Cephalic fins measuring a little less than the width of the mouth; spiracles behind the eyes. The space between the last branchial clefts one fourth that between the first. Dorsal fin between the ventrals. Tail slender, without spine, nearly twice as long as the body. Length of disk without cephalic appendages 0.350, width of disk 0.780, cephalic fin 0.090, width of mouth 0.105, diameter of eye 0.012, ventral fin 0.070, and tail 0.620 metres.

Black above, white beneath. Grows to a very large size.

Jamaica."

Manta.

Manta Bancroft, 1829, Zool. journ., **4**, p. 454.
Ceratoptera Müller & Henle, 1837, Sitzb. Akad. wiss. Berlin, p. 118.

Head broad, flat, truncate; mouth very wide, anterior; internarial space very wide; rostrum short, broad; rostral fins distinct from the pectorals, directed forward. Teeth on the lower jaw only, very small, in numerous rows. Tail slender, whip-like, without (? or with) a serrated caudal spine (Lesueur states that a spine is present on specimens of *M. birostris*). A small dorsal between the ventrals. It is not known whether the cephalic fins are rolled as in Mobula.

Teeth extending over whole width of lower jaw
rows separated, about 100 . . . . . *birostris* (page 454)
Teeth not extending over whole width of lower jaw
rows close together, about 200 . . . . *ehrenbergii* (page 455)

Manta birostris.

Manta birostris Walbaum, 1792, Artedi, p. 535; Donndorff, 1798, Zool. beytr., **3**, p. 879.
La raie manatia Lacépède, 1798, Poissons, **1**, p. 160, pl. 7, f. 2.
Raia manatia Schneider, 1801, Bloch Ichth., p. 364.
Raia fimbriata Lacépède, 1802, Poissons, **4**, p. 677, pl. 16, f. 3.
Cephaloptcrus vampyrus Mitchill, 1824, Ann. N. Y. lyc., **1**, p. 23, pl. 2, f. 1; 1832, Isis, p. 1063, pl. 28, f. 4; DeKay, 1842, N. Y. fish, p. 377, pl. 67, f. 219.

Cephaloptera giorna LESUEUR, 1824, Journ. Acad. nat. sci. Phil., **4**, p. 115, pl. 6.
Sea-devil LAMONT, 1824, Edinb. philos. journ., **11**, p. 113.
Cephalopterus manta BANCROFT, 1829, Zool. journ., **4**, p. 454.
Manta americana BANCROFT, 1829, Zool. journ., **4**, p. 454.
Ceratoptera johnii MÜLLER & HENLE, 1841, Plagios., p. 186, pl. 59.
Brachioptilon hamiltoni NEWMAN, 1849, Zoologist, p. 74.
Cephalopterus diabolus VALENCIENNES, 1850, Cuv. Reg. anim., pl. 119.
Diabolichthys elliotti HOLMES, 1856, Proc. Elliot soc. nat. hist., **1**, p. 39.
Ceratoptera vampirus DUMÉRIL, 1865, Elasm., p. 660.
Ceratoptera vampyrus GÜNTH., 1870, Cat. fishes Brit. mus., **8**, p. 498.
Manta birostris JORDAN & GILBERT, 1882, Bull. 16, U. S. nat. mus., p. 52; JORD. & EVERM., 1896, Bull. 47, U. S. nat. mus., p. 92, pl. 18, f. 39.

Disk nearly twice as wide as long; tail as long as the body including the rostral fins. Pectorals falciform, acute-angled, anterior margin convex, posterior concave. Teeth minute rasp-like, on the lower jaw only, occupying the entire width of the jaw, in about 100 rows separated by interspaces (on the young). Base of the dorsal extending forward little in front of the ends of the bases of the pectorals, and backward to about the middle of the free inner margin of the same fins. Ventrals small, hind margins rounded not reaching to the ends of the pectorals. Body and tail rough.

Mitchill's specimen measured in total length 208, snout to tail 159, cephalic fins 30, across the head 60, and width of disk 192 inches; it weighed between four and five tons as estimated.

Back brown darkening with age; white beneath.

Lesueur says the tail is a little longer than the body and makes a positive assertion as to the presence of a spine on both adult female and foetus. Said to attain a width of twenty feet.

Tropical waters of America.

MANTA EHRENBERGII.

Ceratoptera chrenbergii MÜLLER & HENLE, 1841, Plagios., p. 187; DUMÉRIL, 1865, Elasm., p. 661; GÜNTH., 1870, Cat. fishes Brit. mus., **8**, p. 498; HEMPRICH & EHRENBERG, 1899, Symbolae phys-Zool., pl. 2, Zoot., pl. 10.
Ceratoptera stelligera HEMPRICH & EHRENBERG, 1899, Symbolae phys., Zool., pl. 2, Zoot., pl. 10.
Ceratoptera orissa LLOYD, 1908, Rec. Ind. mus., **2**, p. 176, fig. 1, pl. 5, pl. 10, f. 1, 2.

Total width more than the length of the body including the rostral fins. Teeth band occupying about half the width of the lower jaw; teeth in two-hundred rows or more, close together. Body and tail rough, above and below, with small tubercles on pronged bases.

Back greenish.

Red Sea.

Addenda.

Rhincodon typus. Page 42.

A large specimen of this species was taken near Knights Key, Florida, June 1st, 1912. Its length was given by its captor as 45 feet, its circumference as 23 feet 9 inches, diameter 8 feet 3 inches, width of mouth 38 inches, depth of caudal fin 10 feet, length of dorsal fin 3 feet, height of dorsal fin 2 feet 9 inches. It was said to weigh 30,000 pounds.

The range of this species extends throughout the Indian Ocean and the temperate and the tropical portions of the Pacific and the Atlantic.

Page 167. Triakis venusta.

Calliscyllium venustum Tanaka, 1912, Fishes of Japan, **10**, p. 171, pl. 46.

Slender, elongate, tapering. Body short; tail about five ninths of the total; caudal axis hardly raised. Head depressed, rather narrow and pointed. Snout short, blunted; nostrils nearer to mouth than to end, anterior valves separated on the internarial space by about one third of its width, their inner ends near the mouth cleft. Mouth wide, sharply curved at the symphysis, with a short labial fold around each angle. Teeth small, in longitudinal rows and in transverse series, serrate on the hinder (free) edge with about five short cusps, median largest but not quite as much so as on teeth of *T. scyllium*. Eye longer than wide, lateral, with a nictitating fold. Spiracle small, behind and near the eye. Gill openings small, hindmost two above the pectoral. Scales small, with a median keel, like those of other species of the genus. Dorsal fins nearly equal, hind angles produced; origin of first dorsal about midway from the bases of the pectorals to the ventrals, end of fin hardly reaching to a vertical from the latter. Pectorals little larger than dorsals, base about equal hind margin, inner angle blunt. Ventrals and anal smaller than the dorsals; ventral origins little behind the tip of the first dorsal; anal origin little in front of that of the second dorsal, tip of fin less produced, reaching nearly as far back as the base of this dorsal. Caudals rather small; subcaudal not deep, gradually narrowing backward, separated from the terminal by a notch. Terminal widening backward, obliquely truncated.

Light brownish with numerous (a dozen or more) faint transverse bands or blotches of darker separated by narrower spaces on the upper half of the body;

upper surfaces thickly sprinkled by spots of darker smaller than the eye; lower surfaces lighter, uniform.

Type a female of a total length of 25.47 inches (64.5 cm.).

Sagami Sea, Japan.

Page 196. SQUALUS (CIRRHIGALEUS) BARBIFER.

Cirrhigaleus barbifer TANAKA, 1912, Fishes of Japan, **9**, p. 151, pl. 41, fig. 156–162.

General outlines of the type, a male of about $33\frac{1}{2}$ inches, from the Sagami Sea, Japan, resembling those of a large specimen of *Squalus acanthias*. The mouth, teeth, scales, spiracles, and fins are those of that genus. The positions of the fins recall those in *S. acanthias*, but the dorsals are larger, more nearly alike in size and more nearly equal to the pectorals and the ventrals. Head large, depressed. Spiracle large, near the eye. Mouth moderate, in a low arch. Teeth $\frac{26}{26}$, alike in the two jaws. Gill openings medium, in front of the pectorals. Snout rather short, blunt; nostrils about midway from mouth to end, anterior valve with a slender, pointed barbel (nearly $1\frac{1}{2}$ inches long) on the inner end. Hind margins of the dorsals and pectorals concave. Subcaudal lobe moderate; no notch between subcaudal and terminal; no pit at the origins of the caudals. Dorsal origin opposite the inner angles of the pectorals; origin of second dorsal opposite the axils of the ventrals; first dorsal spine about three fourths as high as its fin; second dorsal spine about equal the height of the fin. Clasper of the male short, thick, obliquely pointed.

The possession of a narial barbel appears to be the character that must be depended on for the characterization of Cirrhigaleus as a subgenus of Squalus. In the type as figured the nostrils are placed close to the end of the snout, fig. 156; on fig. 158 they are seen to be about half way from the mouth to the end, which is probably more nearly in accord with the specimen.

Japan.

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List of Abbreviations.

ag.	angular.
ao.	antorbital.
aqv.	aqueducts of the vestibule.
ar.	angular.
bhy.	basihyal.
bra.	outer branchial stay.
brc.	inner branchial stay.
brr.	branchial rays.
bstr.	basitrabeculae.
cbr.	ceratobranchials.
chy.	ceratohyals.
co.	copula.
cp.	partial copula.
e.	eye or orbit.
ehy.	epihyal.
ebr.	epibranchial.
evs.	epitropeals, supra. & subtropeals.
exbr.	extrabranchials.
ebs.	ceratobranchials.
fo.	foramen.
g.	gill lamellae.
hbr.	hyobranchials.
hm.	hyomandibular.
int.	intestine.
l.	labials.
l′.	lateral expansion of rostral.
ls.	lateral stay.
mk.	lower jaws. Meckelian.
msp.	mesopterygium (nsp. pl. 67).
mtp.	metapterygium.
mx.	maxillaries, quadratopterygoids.
na.	prenarial cartilages.
nv.	nasal valves.
op.	opercular cartilages.
pbr.	epibranchials.
pbs.	posterior branchial support.
pct.	pectoral arch, shoulder girdle.
po.	post orbital process.
prp.	propterygium.
psp.	postspiracular cartilage.
qpg.	quadratopterygoid.
r. or rl.	rostral cartilage.
sbr.	suprabranchials.
sc.	scapular.
so.	supraorbital.
sp.	spiracular.
x.	basal element of eighth arch.

PLATE 1.

PLATE 1.

CESTRACIONTIDAE.

Fig. 1–3. CESTRACION ZYGAENA (Page 157). Fig. 4–6. CESTRACION TIBURO (Page 160).

1. Lateral view of a specimen $27\frac{1}{4}$ inches long.
2. Head from below.
3. Teeth from the side of the jaw.
4. Lateral view of a specimen $21\frac{1}{2}$ inches long.
5. Head from below.
6. Teeth from the side of the jaw.

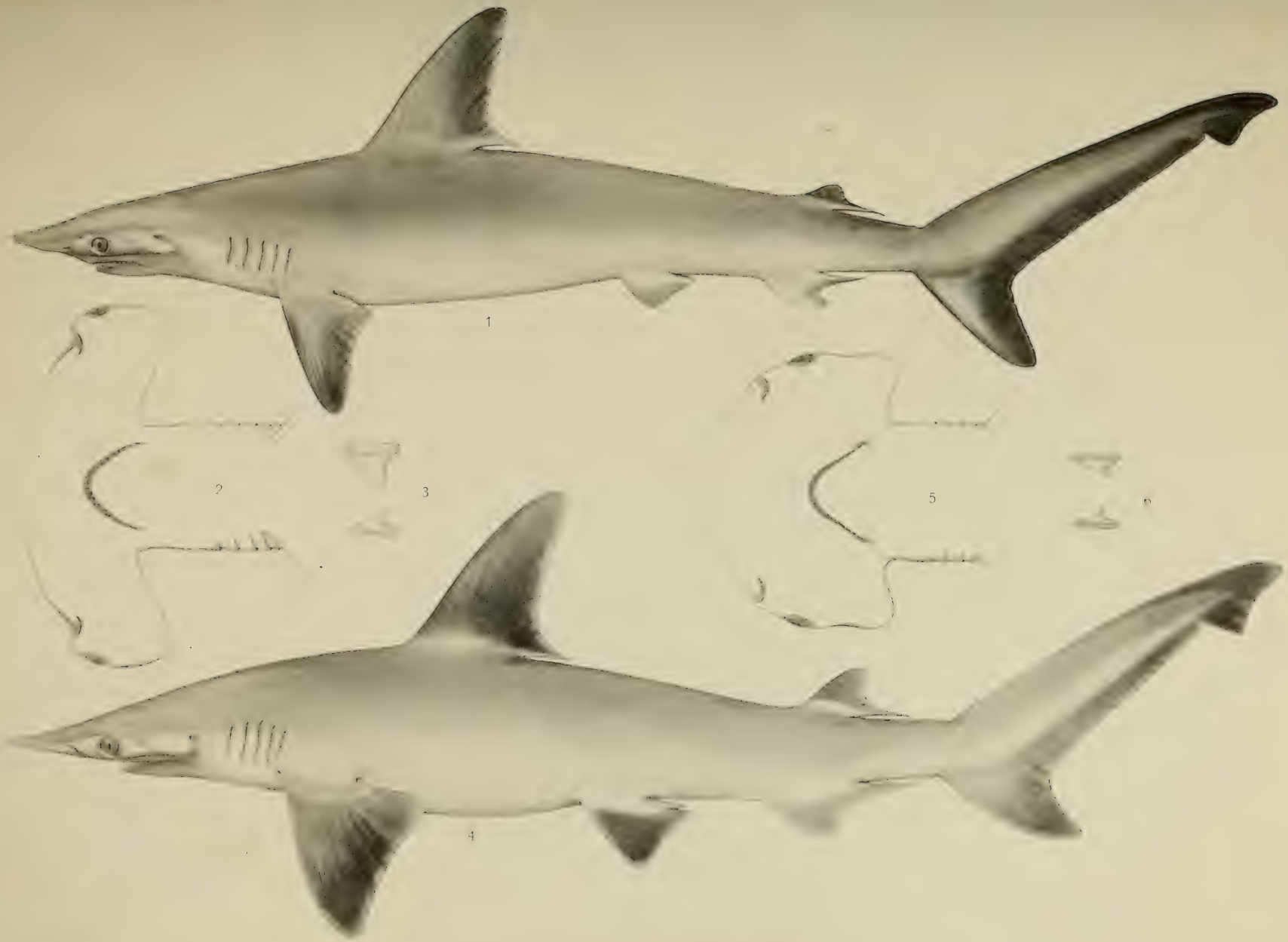
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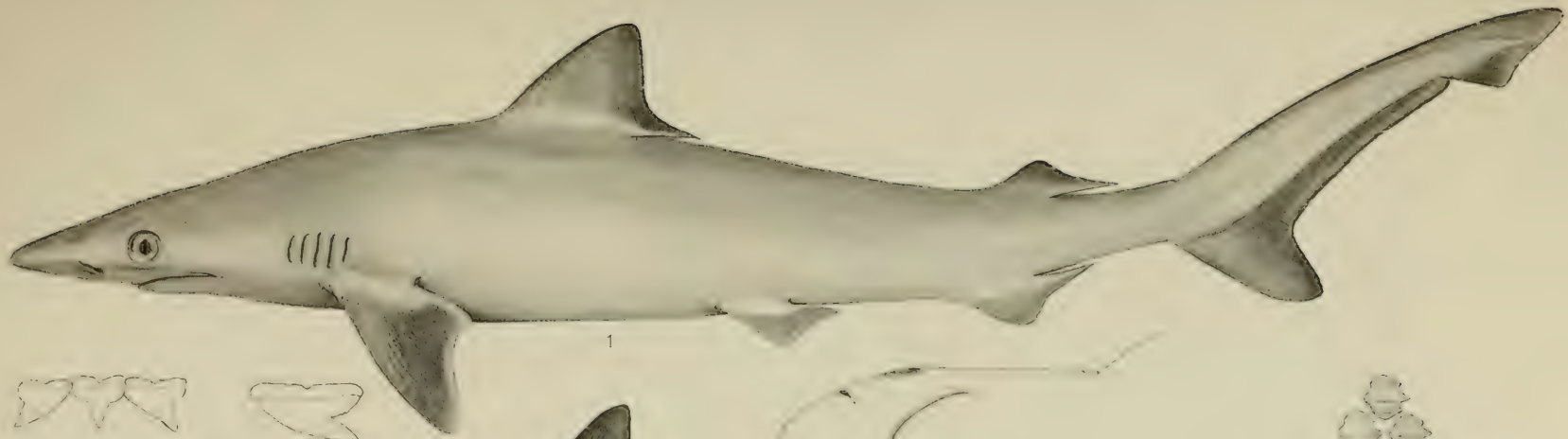
PLATE 2.

PLATE 2.

CARCHARINIDAE.

Fig. 1–4. Scoliodon terrae novae (Page 115). Fig. 5–8. Carcharinus limbatus (Page 127).

1. Lateral view of a specimen $21\frac{3}{4}$ inches long.
2. Head from below.
3. Teeth from the front and from the side of the jaw.
4. Scales from near the middle of the flank.
5. Lateral view of a specimen 34 inches long.
6. Head from below.
7. Teeth from the front and from the side of the jaw.
8. Scales from near the middle of the flank.



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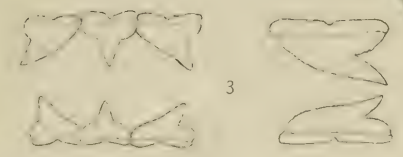

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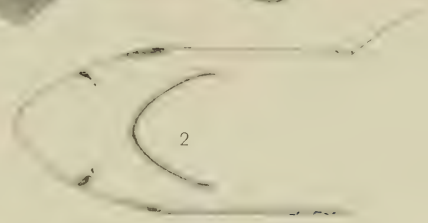

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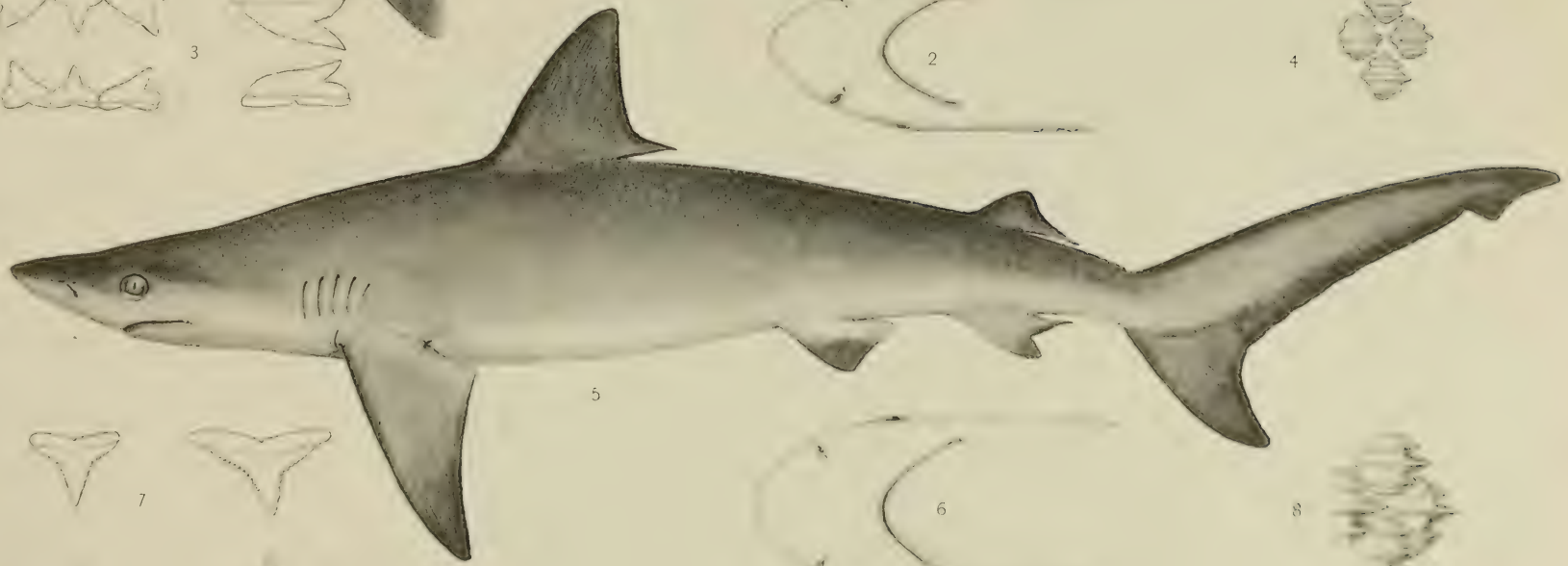

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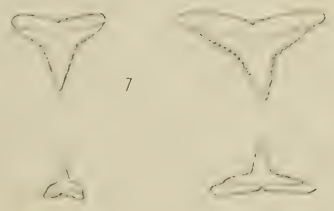

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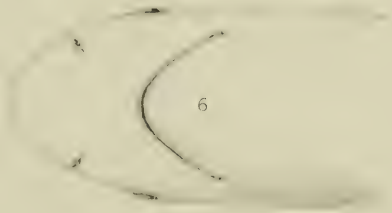

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PLATE 3.

PLATE 3.

CARCHARINIDAE.

Fig. 1–3. Galeus glaucus (Page 145). Fig. 4–6. Carcharinus platyodon (Page 126).

1. Lateral view.
2. Teeth from the forward end of the jaw.
3. Head from below.
4. Lateral view.
5. Teeth from the forward end of the jaw.
6. Head from below.

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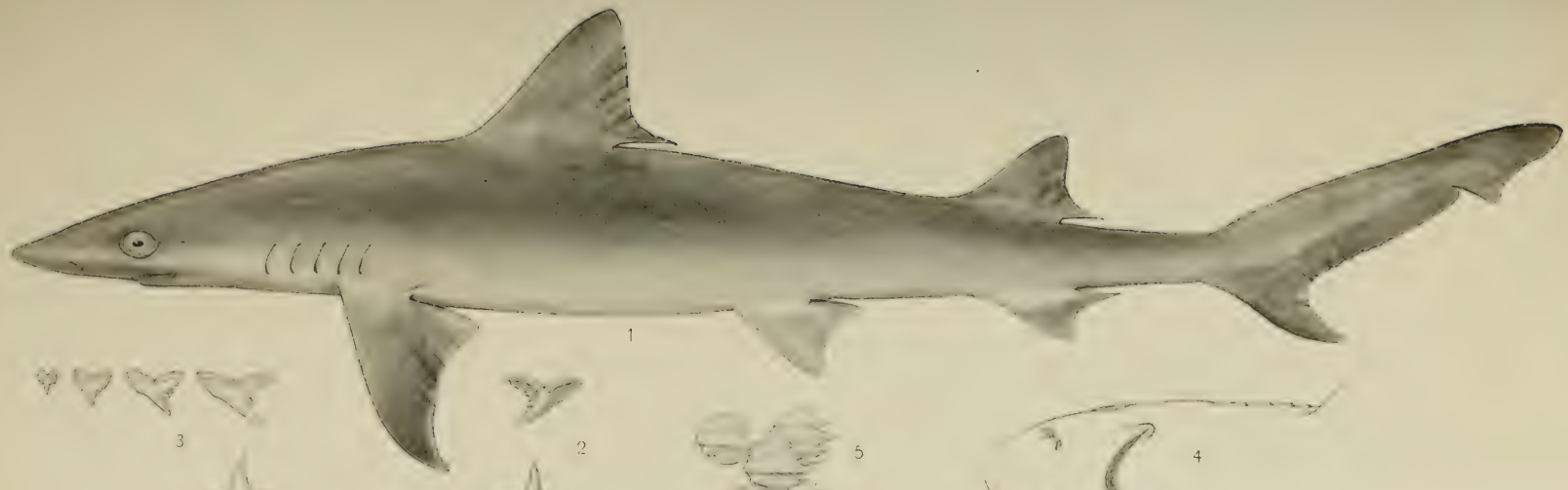
PLATE 4.

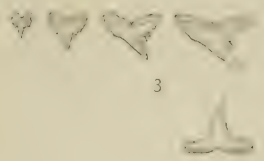
PLATE 4.

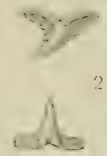
CARCHARINIDAE and GALEORHINIDAE.

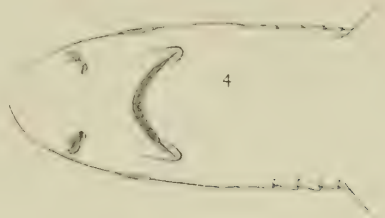
Fig. 1–5. HEMIGALEUS PECTORALIS (Page 150). Fig. 6–9. GALEORHINUS LAEVIS (Page 176).

1. Lateral view of a specimen 25½ inches long.
2. Teeth from the inner side.
3. Forward teeth from the outer side.
4. Head from below.
5. Scales from the middle of the flank.
6. Lateral view of a specimen 27 inches long.
7. Head from below.
8. Teeth from near the front end of the jaw.
9. Scales from near the middle of the flank.









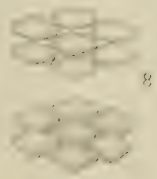


PLATE 5.

PLATE 5.

PLATE 5.

GALEORHINIDAE and ISURIDAE.

Fig. 1–4. TRIAKIS HENLEI (Page 168). Fig. 5–9. CARCHARODON CARCHARIAS (Page 32).

1. Lateral view of a specimen 25½ inches long.
2. Teeth from near the front end of the jaw.
3. Head from below.
4. Scales from near the middle of the flank.
5. Lateral view.
6. Teeth from near the front end of the jaw.
7. Nostril.
8. Head from below.
9. Scales from near the middle of the flank.

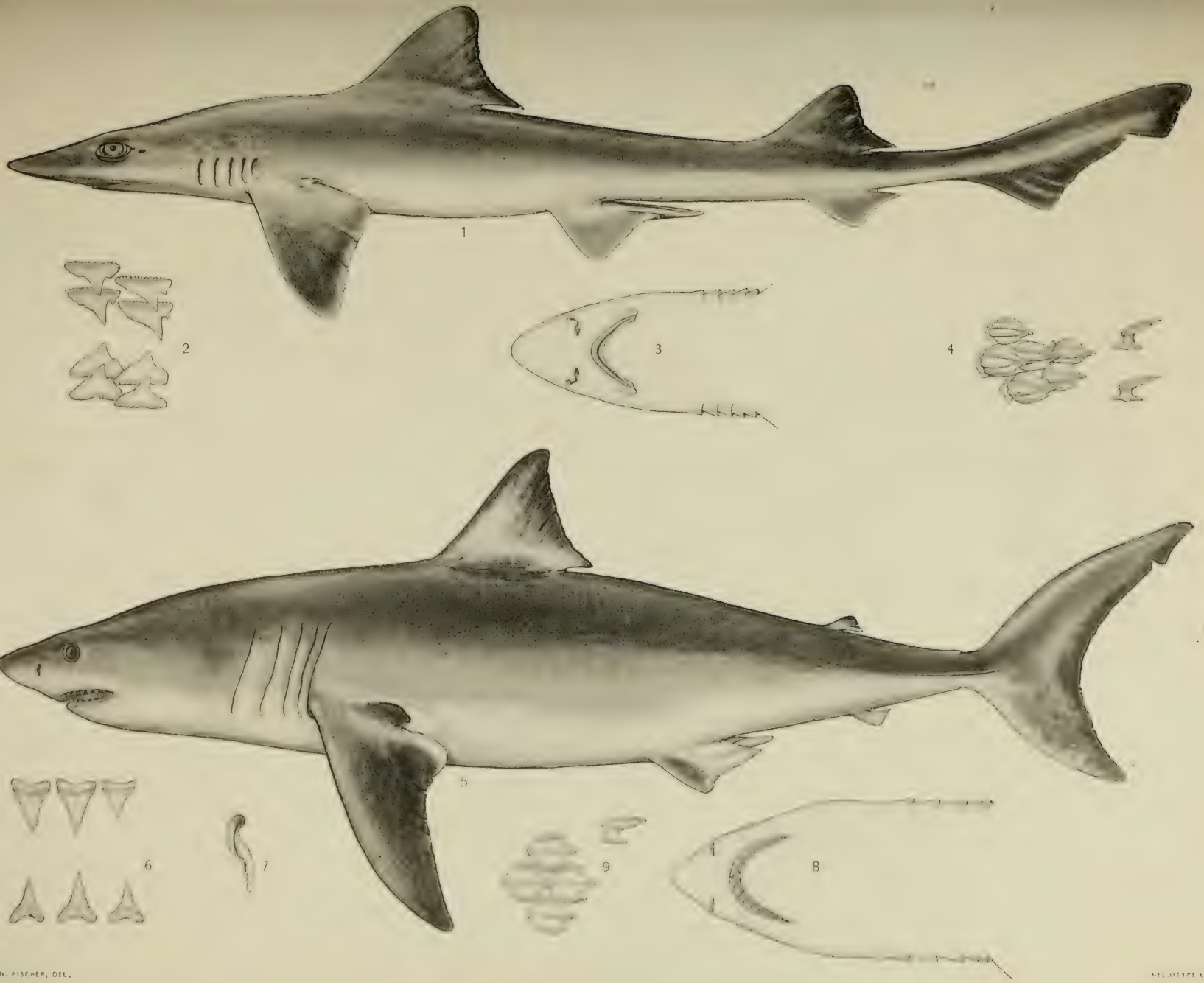


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PLATE 6.

PLATE 6.

CARCHARIIDAE and ISURIDAE.

Fig. 1–3. CARCHARIAS TAURUS (Page 25). Fig. 4–6. ISURUS PUNCTATUS (Page 36).

1. Lateral view of a specimen 42 inches long.
2. Teeth from the front end of the jaw.
3. Head from below.
4. Lateral view.
5. Teeth from near the front end of the jaw.
6. Head from below.

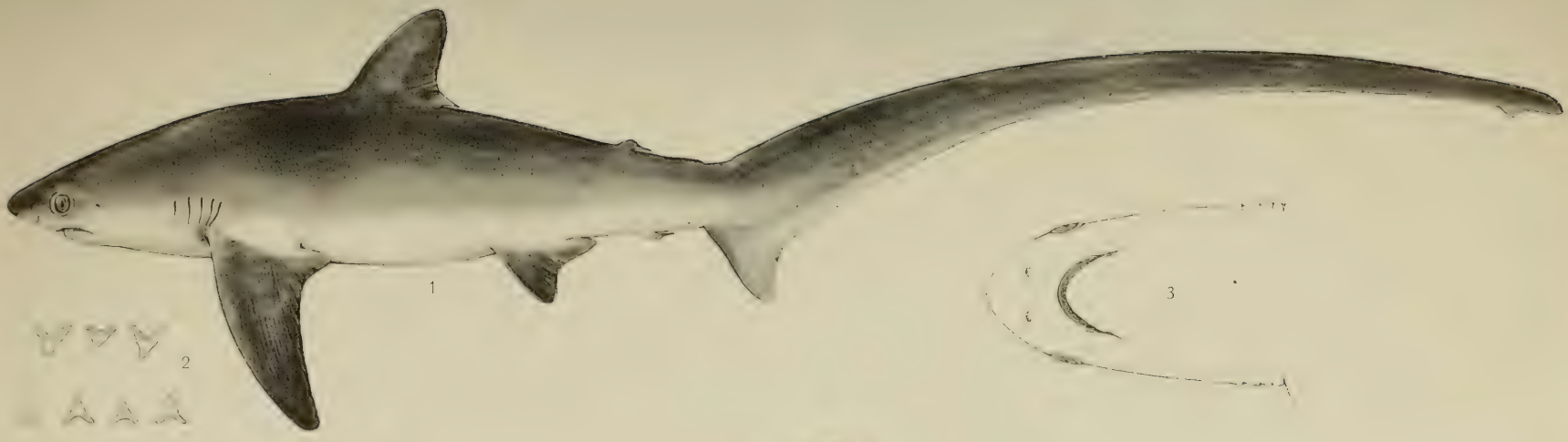
PLATE 7.

PLATE 7.

VULPECULIDAE and ORECTOLOBIDAE.

Fig. 1–3 VULPECULA MARINA (Page 30). Fig. 4–6. GINGLYMOSTOMA CIRRATUM (Page 54).

1. Lateral view of a specimen 53 inches long.
2. Teeth from near the front end of the jaw.
3. Head from below.
4. Lateral view of a specimen $14\frac{3}{8}$ inches long.
5. Teeth from near the front end of the jaw.
6. Head from below.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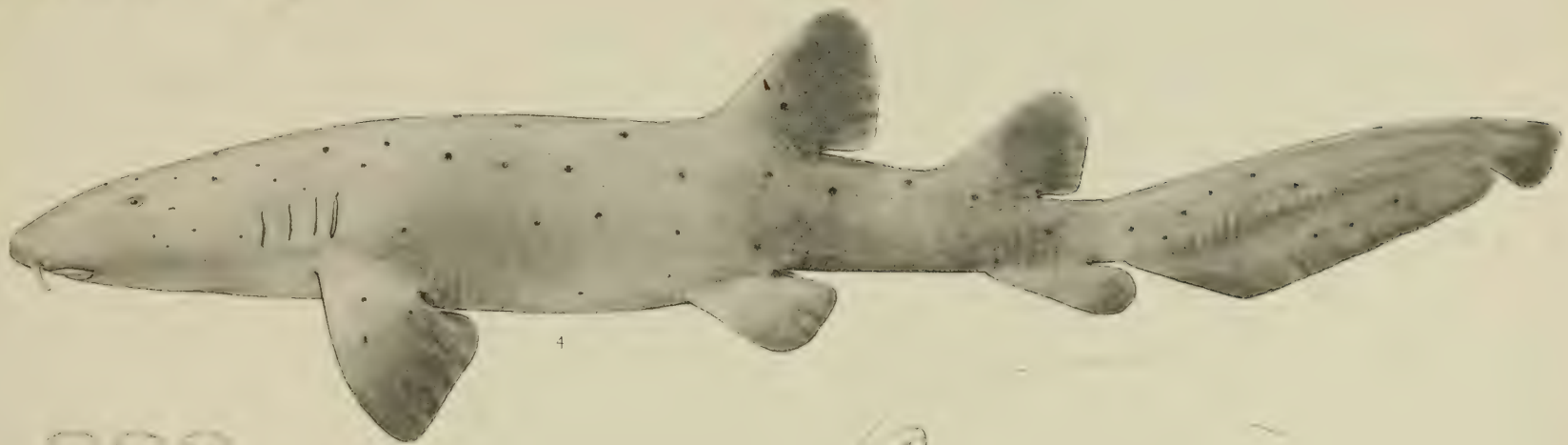
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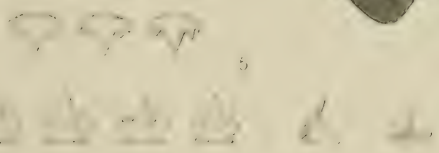
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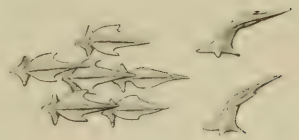
PLATE 8.

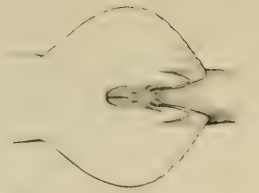
PLATE 8.

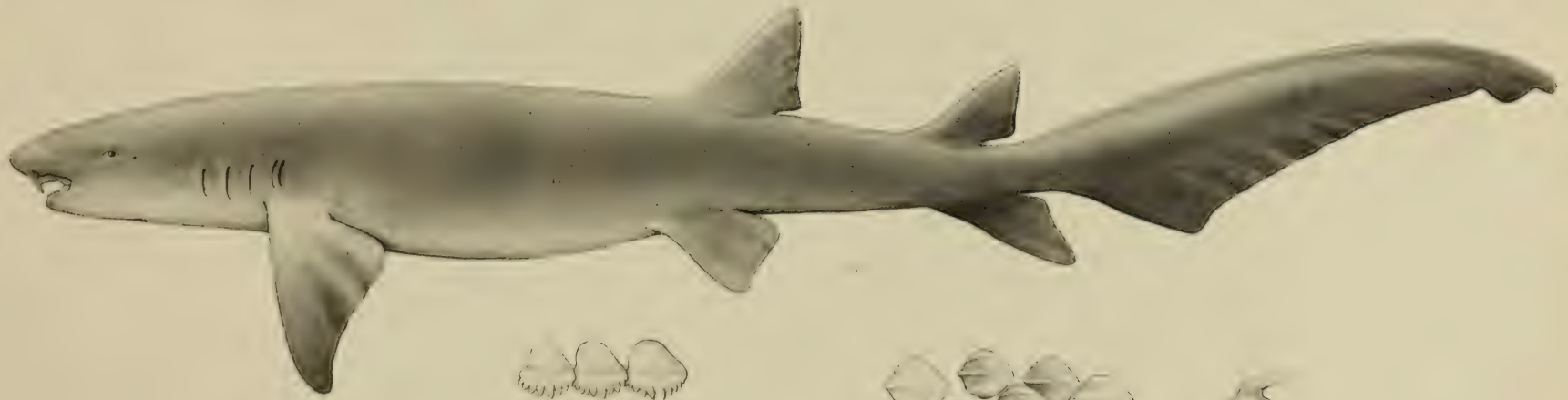
CATULIDAE and ORECTOLOBIDAE.

Fig. 1–6. PARMATURUS PILOSUS (Page 89). Fig. 7–10. NEBRODES MACRURUS (Page 58).

1. Lateral view of a specimen 17 inches long.
2. Head from below.
3. Teeth from near the front end of the jaw.
4. Scales from near the middle of the flank.
5. Lateral view of scales.
6. Ventral fins.
7. Lateral view of a specimen $31\frac{1}{2}$ inches long.
8. Teeth from near the front end of the jaw.
9. Scales from near the middle of the flank.
10. Lateral view of scales.







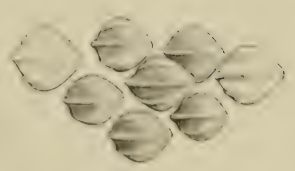


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PLATE 9.

PLATE 9.

CATULIDAE.

Fig. 1–5. PARMATURUS XANIURUS (Page 90). Fig. 6–9. CEPHALOSCYLLIUM VENTRIOSUM (Page 80).

1. Lateral view of a specimen $21\frac{3}{4}$ inches long.
2. Head from below.
3. Teeth from near the front end of the jaw.
4. Scales from near the middle of the flank.
5. Egg-case.
6. Lateral view.
7. Head from below.
8. Teeth from front and side of jaw.
9. Scales from different parts of the body.

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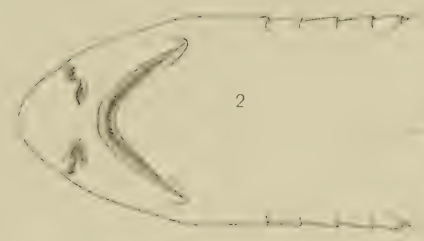

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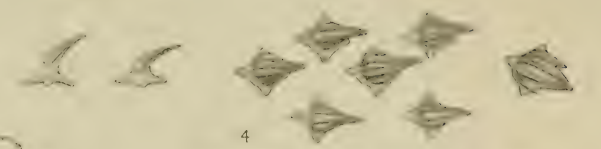

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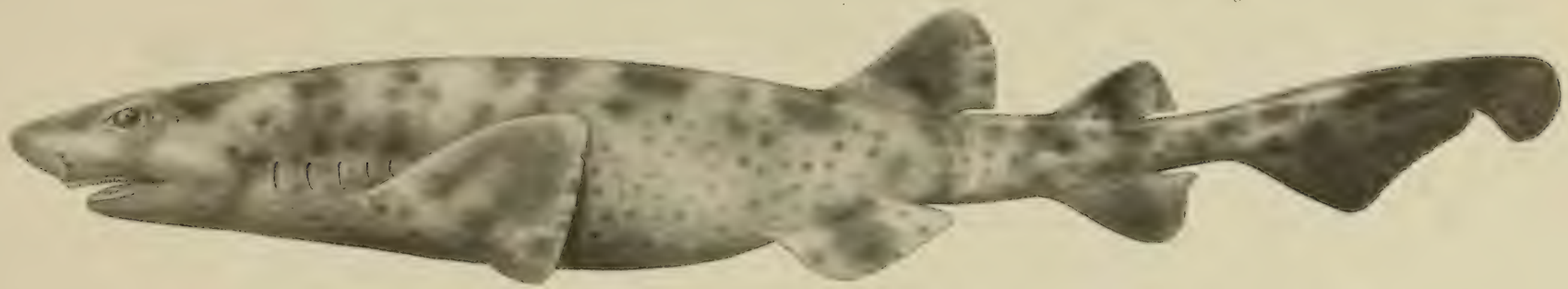

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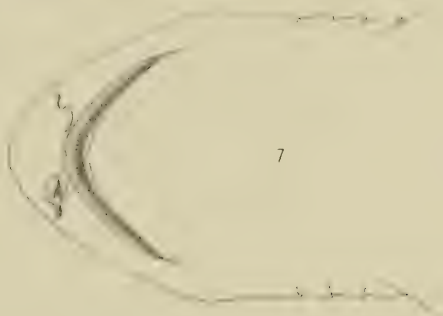

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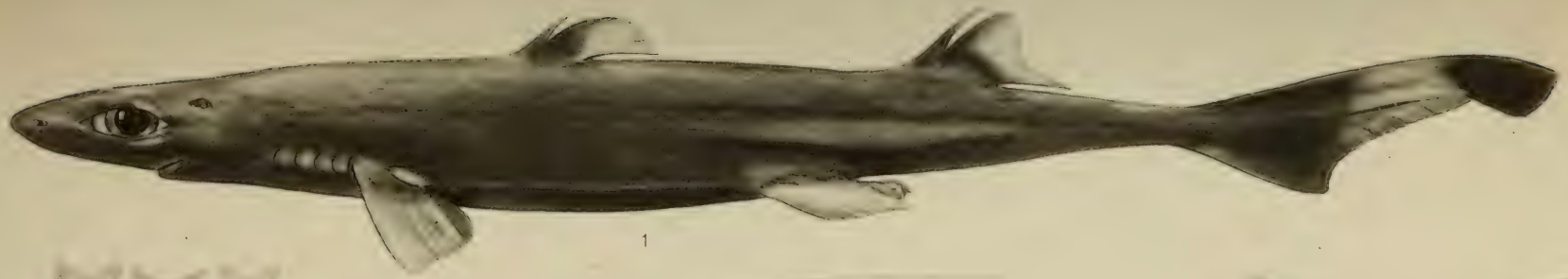
PLATE 10.

PLATE 10.

SQUALIDAE.

Fig. 1–4. ETMOPTERUS HILLIANUS (Page 224). Fig. 5–8. CENTROSCYLLIUM FABRICII (Page 231).

1. Lateral view of a specimen $9\frac{3}{4}$ inches long.
2. Teeth from the front end of the jaw.
3. Head from below.
4. Scales from near the middle of the flank.
5. Lateral view.
6. Teeth from near the front end of the jaw.
7. Head from below.
8. Scales from near the middle of the flank.



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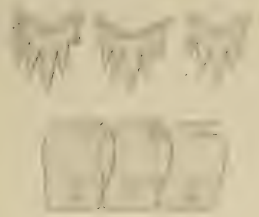

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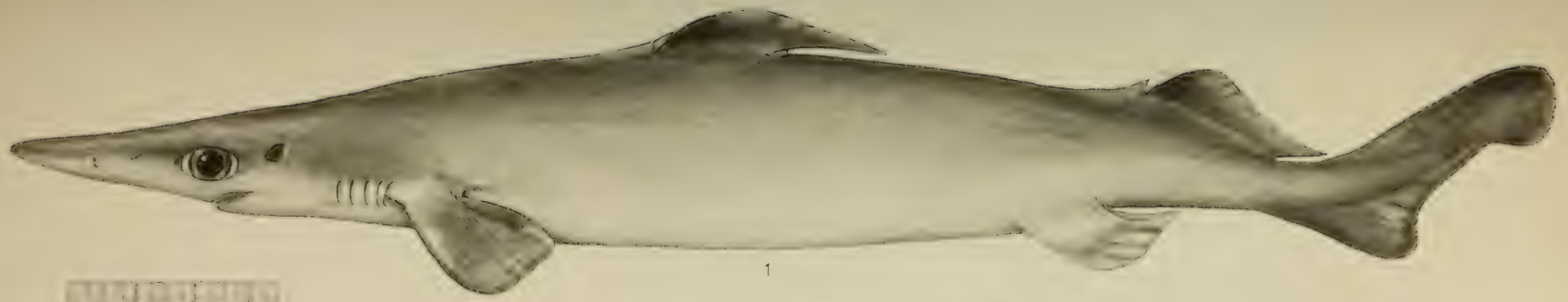
PLATE 11.

PLATE 11.

SQUALIDAE.

Fig. 1–4. Acanthidium rostratum (Page 218). Fig. 5–8. Acanthidium hystricosum (Page 220).

1. Lateral view of a specimen 34 inches long.
2. Head from below.
3. Teeth from the front end of the jaw.
4. Scales from near the middle of the flank.
5. Lateral view of a specimen $36\frac{1}{4}$ inches long.
6. Head from below.
7. Teeth from the front end of the jaw.
8. Scales from near the middle of the flank.



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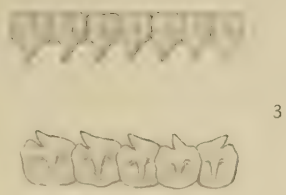

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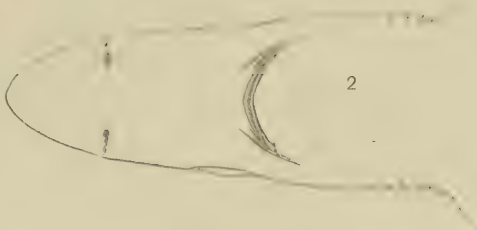

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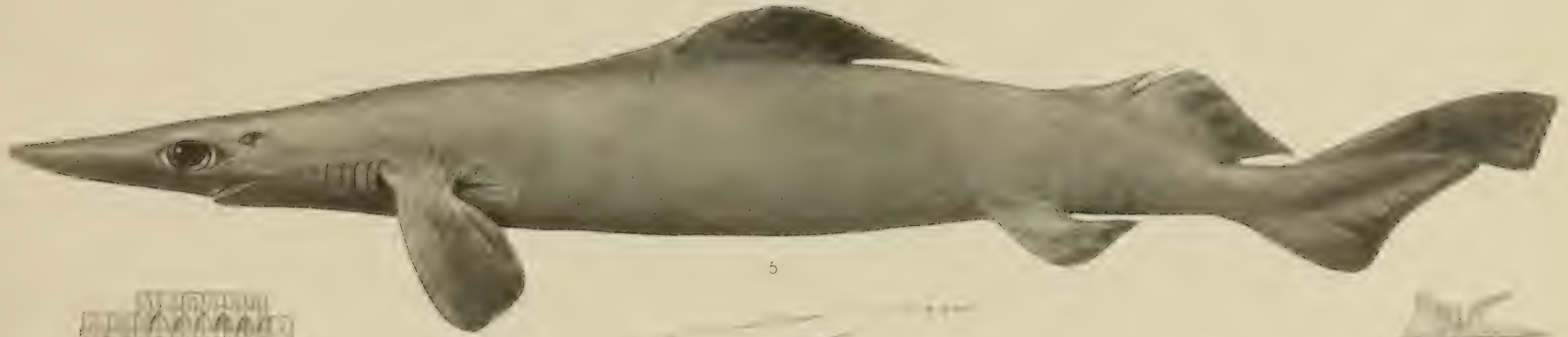

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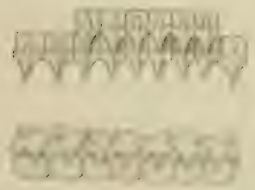

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PLATE 12.

PLATE 12.

SQUALIDAE.

Fig. 1–4. Acanthidium aciculatum (Page 217). Fig. 5–8. Centrophorus acus (Page 199).

1. Lateral view of a specimen $34\frac{1}{8}$ inches long.
2. Teeth from the front end and from the side of the jaw.
3. Head from below.
4. Scales from the middle of the flank.
5. Lateral view of a specimen $32\frac{1}{4}$ inches long.
6. Teeth from the front end of the jaw.
7. Head from below.
8. Scales from near the middle of the flank.

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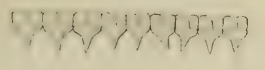

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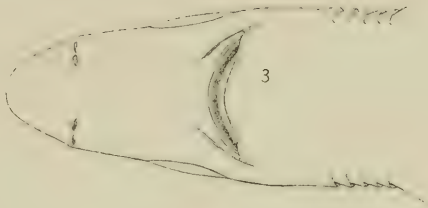

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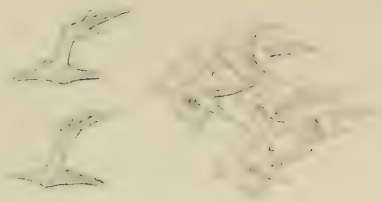

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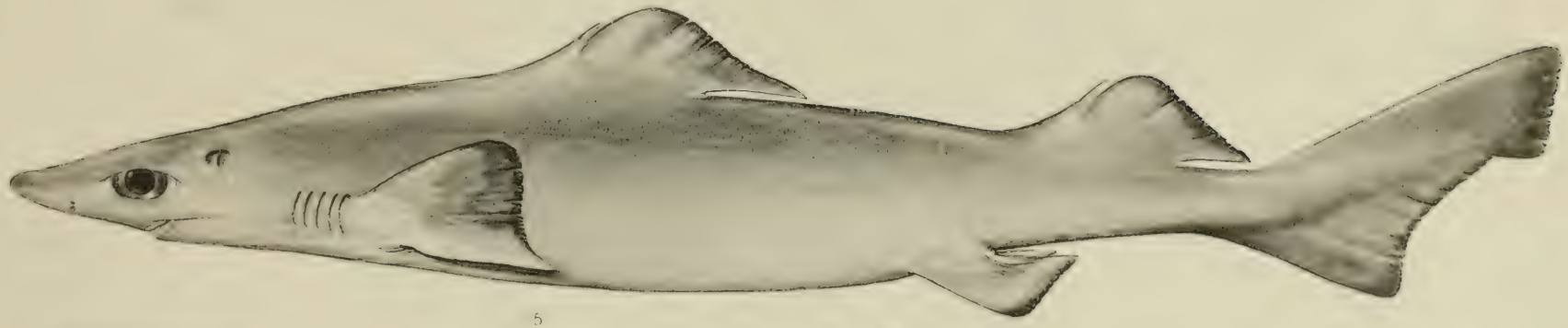

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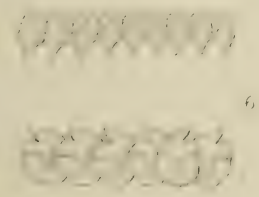

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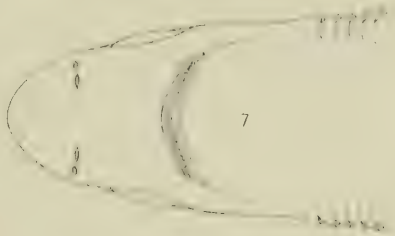

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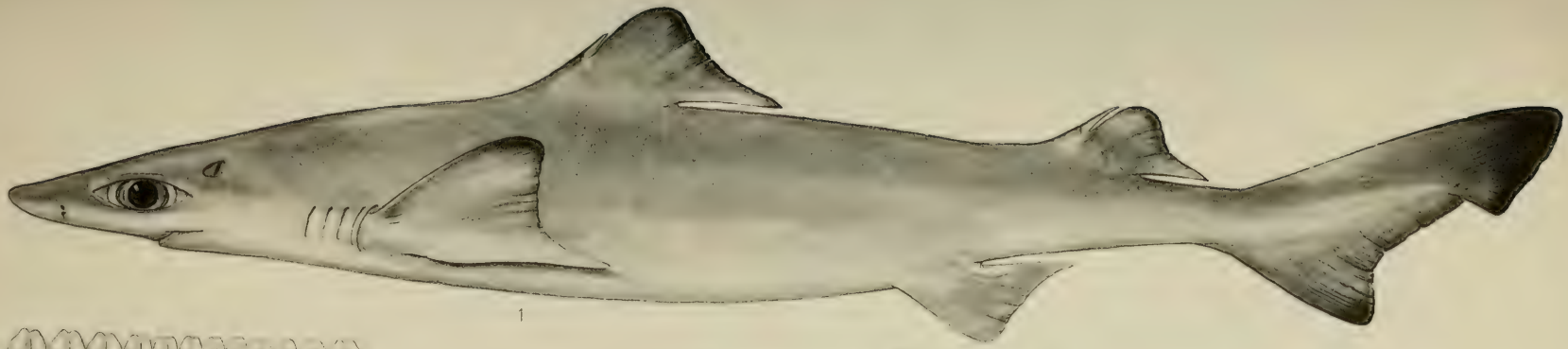
PLATE 13.

PLATE 13.

SQUALIDAE.

Fig. 1–4. Centrophorus atromarginatus (Page 200). Fig. 5–8. Centroscymnus owstonii (Page 205).

1. Lateral view of a specimen 34 inches long.
2. Teeth from the front end of the jaw.
3. Head from below.
4. Scales from near the middle of the flank.
5. Lateral view of a specimen $30\frac{3}{4}$ inches long.
6. Teeth from the front end of the jaw.
7. Head from below.
8. Scales from near the middle of the flank.



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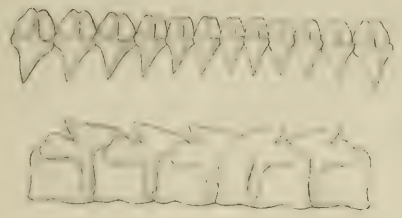

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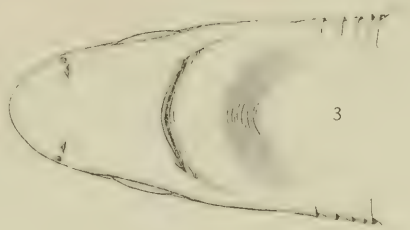

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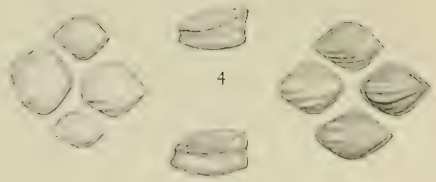

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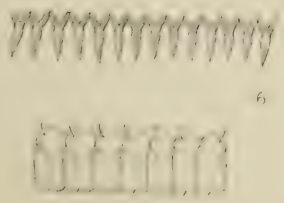

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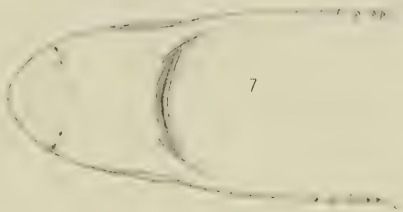

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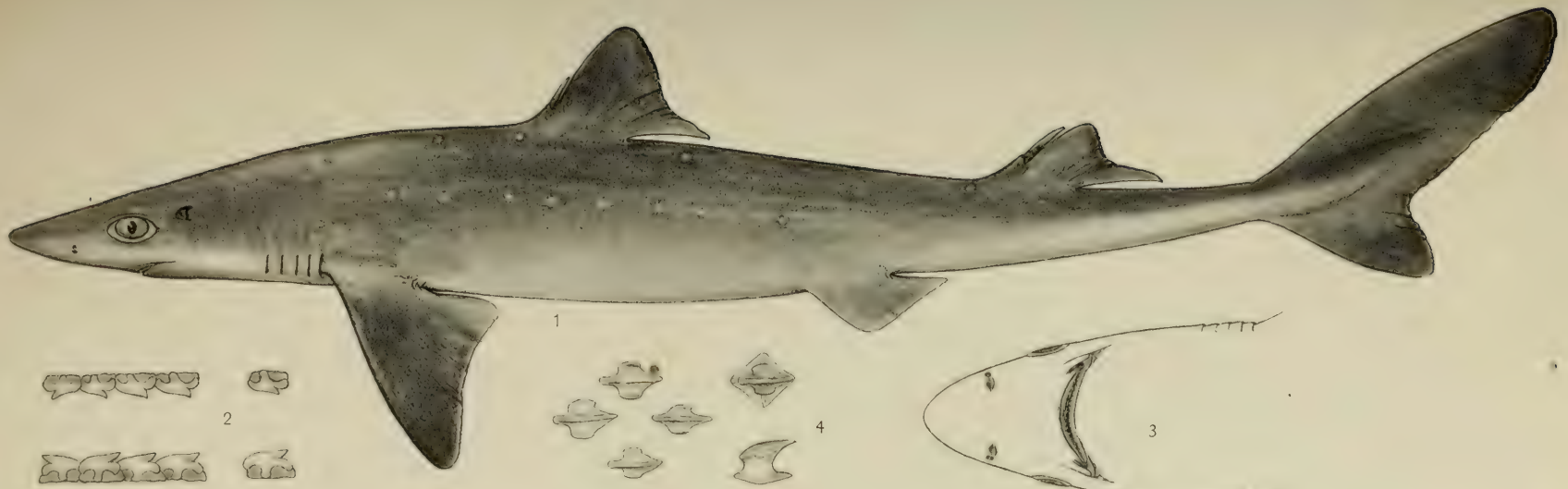
PLATE 14.

PLATE 14.

SQUALIDAE.

Fig. 1–4. Squalus acanthias (Page 192). Fig. 5–8. Centroscymnus coelolepis (Page 204).

1. Lateral view of a specimen 27 inches long.
2. Teeth from the front end of the jaw.
3. Head from below.
4. Scales from near the middle of the flank.
5. Lateral view of a specimen 44 inches long.
6. Teeth from near the front end of the jaw.
7. Head from below.
8. Scales from the middle of the flank.



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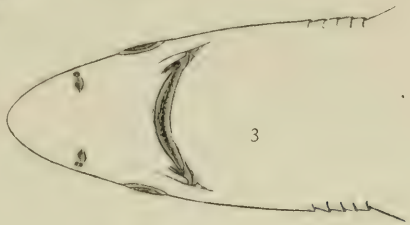

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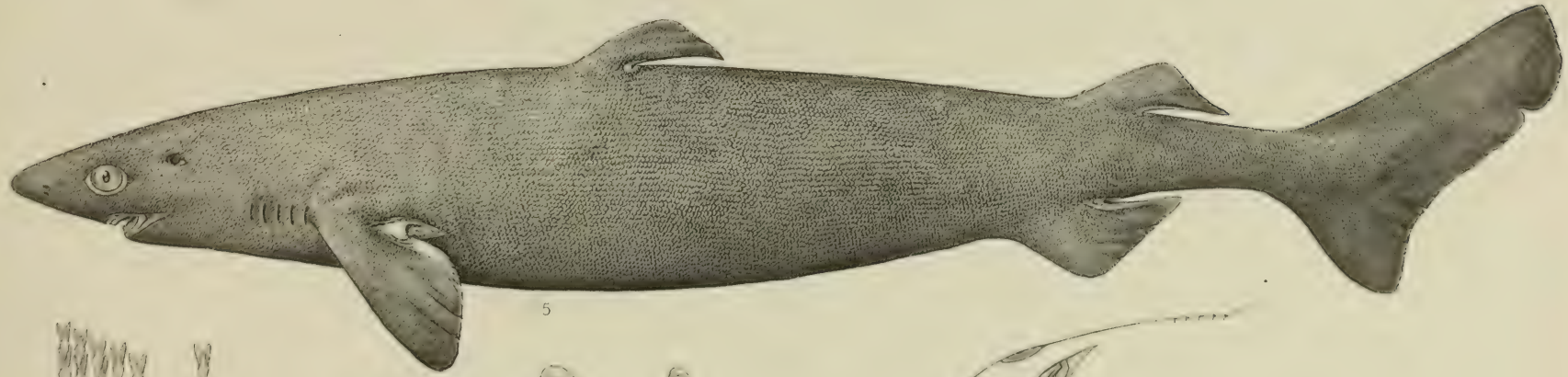

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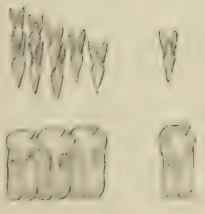

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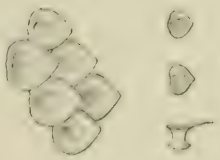

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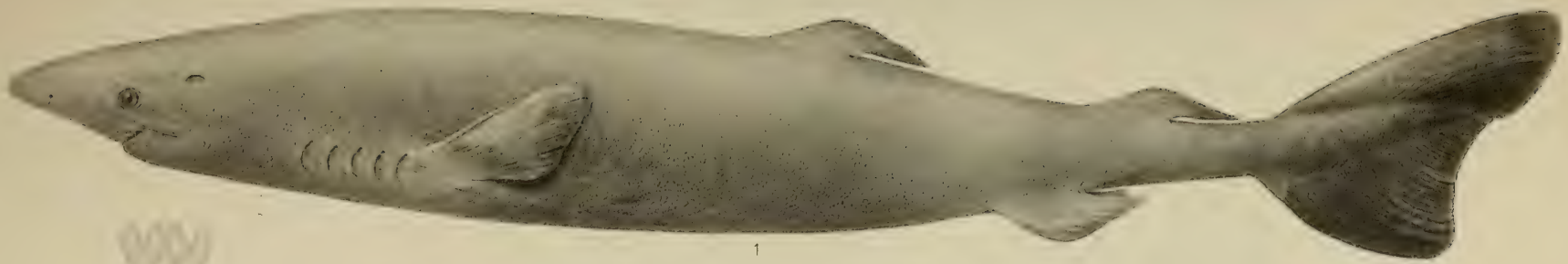
PLATE 15.

PLATE 15.

SCYMNORHINIDAE.

Fig. 1–3. Somniosus brevipinna (Page 240). Fig. 4–6. Somniosus microcephalus (Page 241).

1. Lateral view of a specimen 75 inches long.
2. Teeth from side near the front end of the jaw.
3. Scales from the middle of the flank.
4. Lateral view of a specimen 106 inches long.
5. Teeth from near the front end of the jaw.
6. Scales from the middle of the flank.



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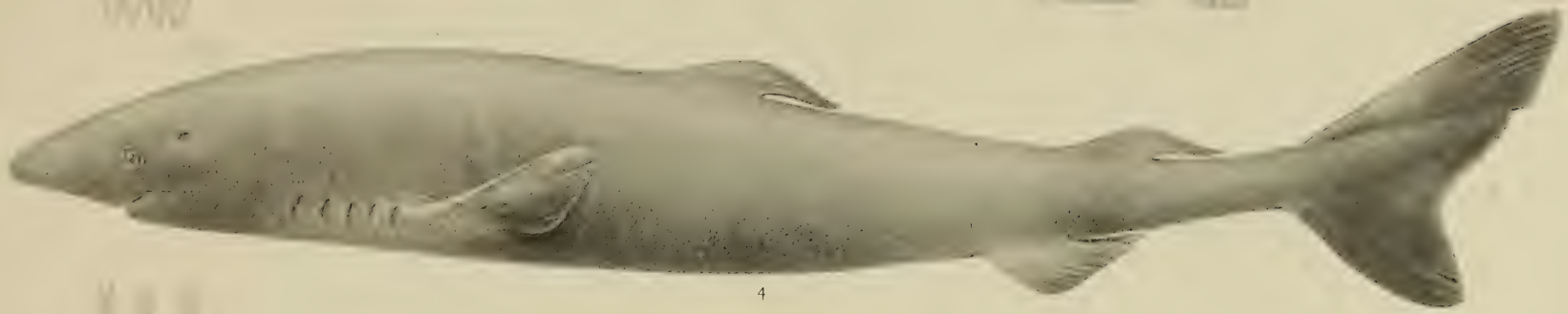

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PLATE 16.

PLATE 16.

RHINIDAE and PRISTIDAE.

Fig. 1–4. Rhina californica (Page 253). Fig. 5–7. Pristis clavata (Page 263).

1. Dorsal view of a specimen $12\frac{1}{8}$ inches long.
2. Frontal view of the head.
3. Teeth.
4. Scales from the middle of the body.
5. Dorsal view of a specimen $24\frac{3}{8}$ inches long.
6. Forward teeth.
7. Scales from near the middle of the body.

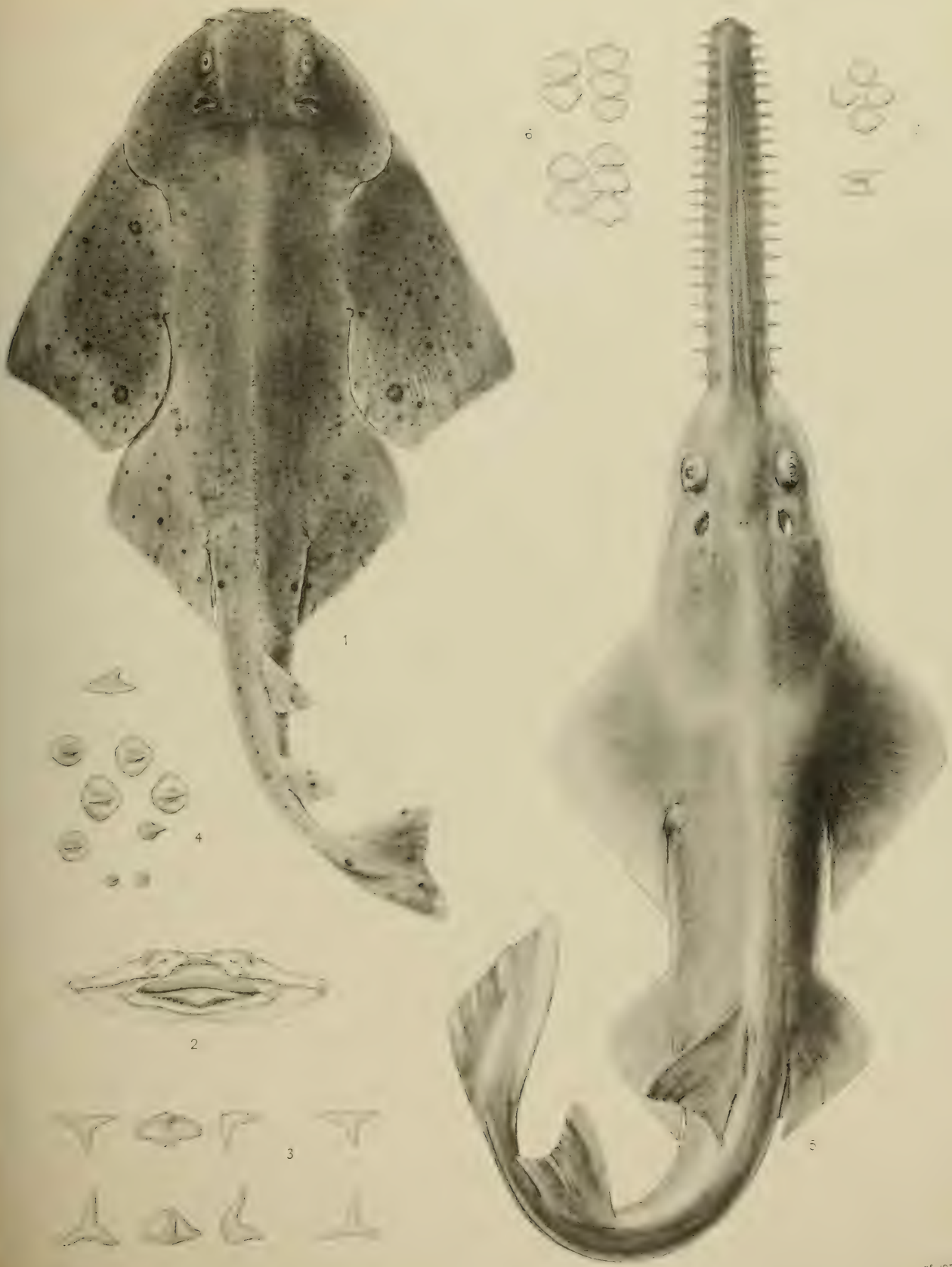

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PLATE 17.

PLATE 17.

RHINOBATIDAE.

Fig. 1–2. Rhinobatus lentiginosus (Page 279).

1. Dorsal view of a specimen $22\frac{3}{4}$ inches long.
2. Ventral view.

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HELIOTYPE CO.

PLATE 17ª.

PLATE 17a.

RHINOBATIDAE.

Fig. 1–2. Rhinobatus rasus (Page 270). Fig. 3–4. Rhinobatus planiceps (Page 283).

1. Dorsal view of a specimen $14\frac{7}{8}$ inches long.
2. Head from below.
3. Dorsal view of a specimen $17\frac{7}{8}$ inches long.
4. Head from below.

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HELIOTYPE CO.

PLATE 17b.

PLATE 17[b].

RHINOBATIDAE and RAIIDAE.

Fig. 1–2. Rhinobatus acutus (Page 273). Fig. 3. Raia kincaidii (Page 343).

1. Dorsal view of a specimen $13\frac{7}{16}$ inches long.
2. Head from below.
3. Dorsal view of a specimen 12 inches long.

PLATE 18.

PLATE 18.

RAIIDAE.

Fig. 1. RAIA PLUTONIA (Page 335). Fig. 2. RAIA ORNATA (Page 336).

1. Dorsal view of a specimen $9\frac{5}{8}$ inches long.
2. Dorsal view of a specimen $6\frac{1}{2}$ inches long.

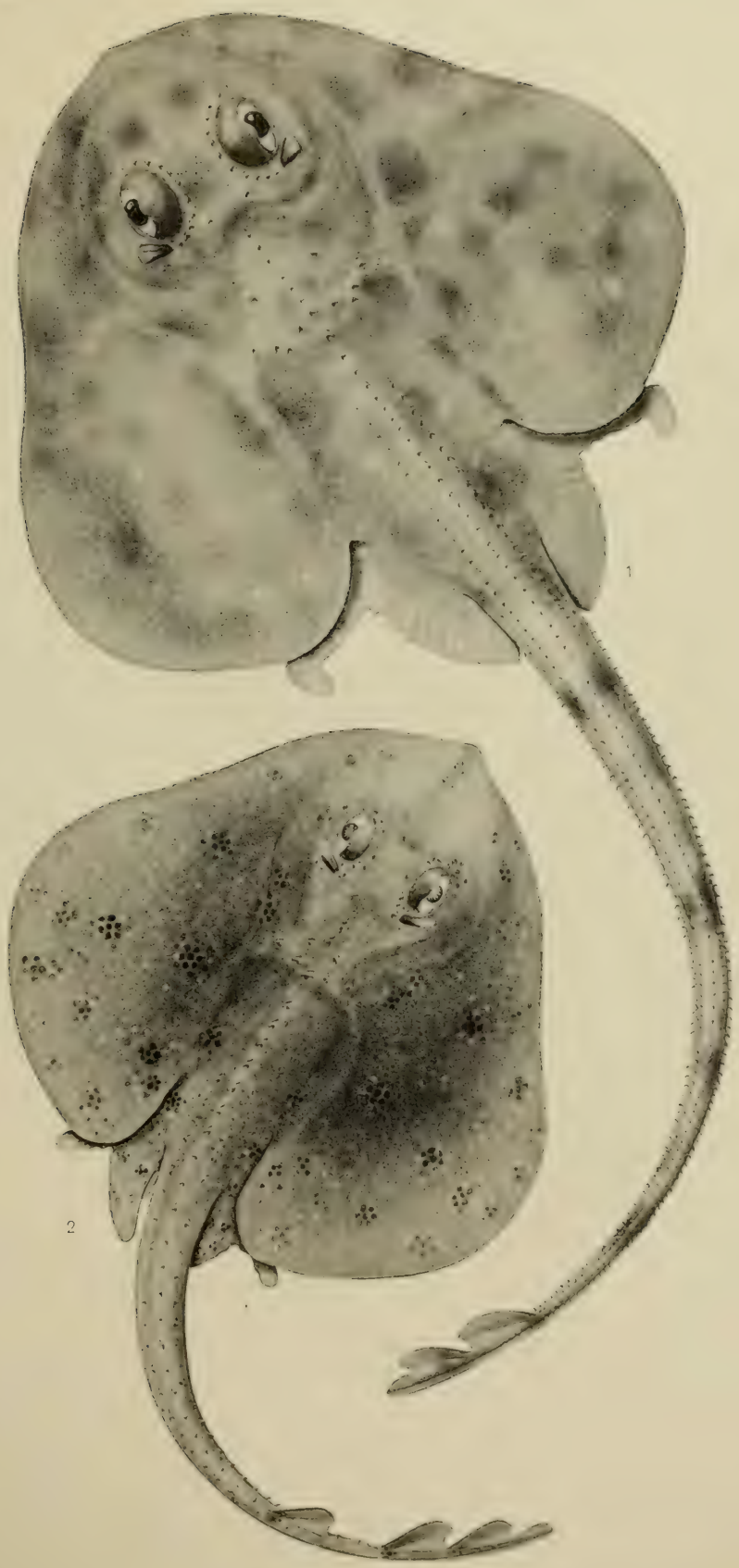

PLATE 19.

PLATE 19.

RAIIDAE.

Fig. 1–2. Raia ackleyi (Page 336).

1. Dorsal view.
2. Head from below.

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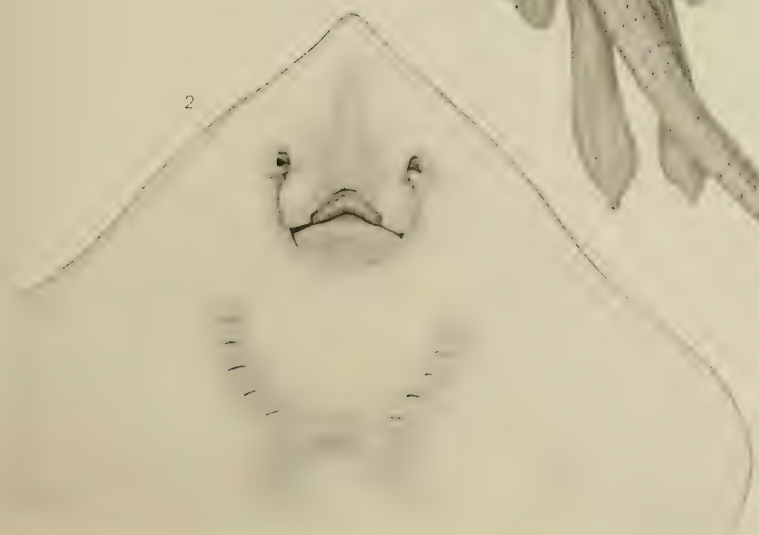

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PLATE 20.

PLATE **20.**

RAIIDAE.

Fig. 1–2. RAIA ERINACEA (Page 337).

1. Dorsal view of a specimen $19\frac{1}{2}$ inches long.
2. Head from below.

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PLATE 21.

PLATE 21.

RAIIDAE.

Fig. 1–2. RAIA SCABRATA (Page 340).

1. Dorsal view of a specimen $14\frac{1}{8}$ inches long. M. C. Z. 365.
2. Dorsal view of a specimen $31\frac{1}{4}$ inches long. M. C. Z. 1139.

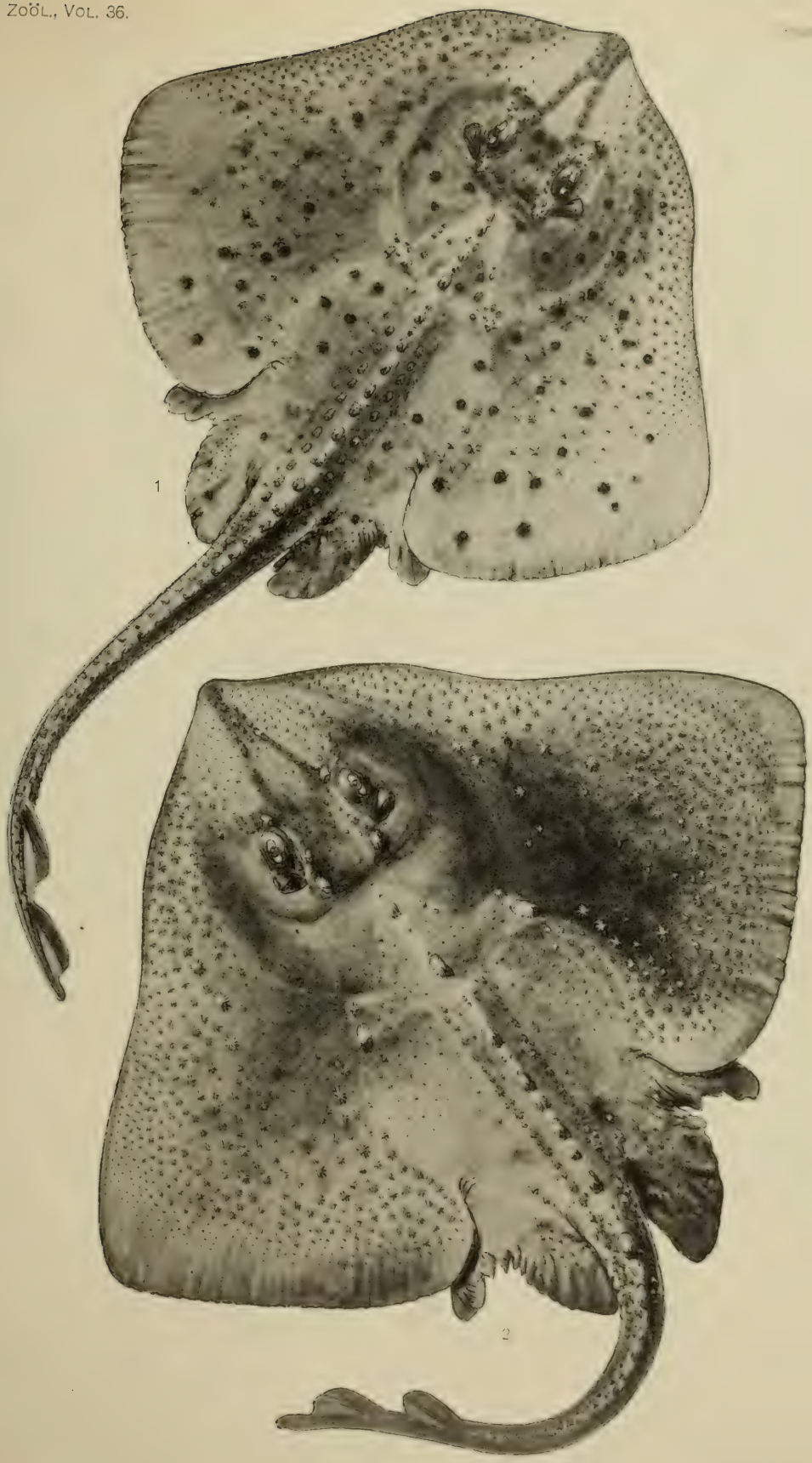

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PLATE 22.

PLATE 22.

RAIIDAE.

Fig. 1. RAIA DIAPHANES (Page 339). Fig. 2. RAIA STABULIFORIS (Page 341).

1. Dorsal view of a specimen $36\frac{1}{4}$ inches long. M. C. Z. 1136.
2. Dorsal view of a specimen $47\frac{1}{2}$ inches long. M. C. Z. 1138.

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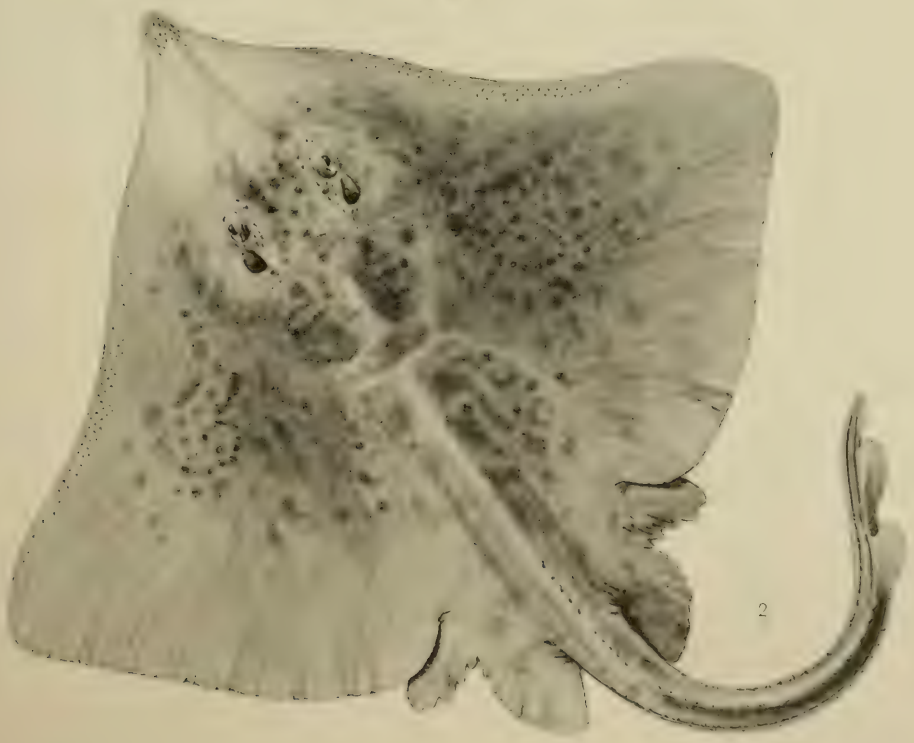

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A. F. Scher, del.

Heliotype Co.

PLATE 23.

PLATE **23**.

RAIIDAE.

Fig. 1–2. RAIA EGLANTERIA (Page 341).

1. Dorsal view of a specimen 21 inches long. M. C. Z. 878.
2. Head from below.

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E. N. F. SCHEP, DEL.

HELIOTYPE CO.

PLATE 24.

PLATE 24.

RAIIDAE and NARCACIONTIDAE.

Fig. 1–2. Raia kenojei (Page 351). Fig. 3. Narke japonica (Page 314). Fig. 4–5. Raia fusca (Page 349).

1. Dorsal view of a specimen $17\frac{3}{8}$ inches long. M. C. Z. 1125.
2. Mouth and nostrils.
3. Dorsal view of a specimen $10\frac{3}{8}$ inches long. M. C. Z. 1121.
4. Dorsal view of a specimen $4\frac{3}{4}$ inches long. M. C. Z. 1240.
5. Ventral view.

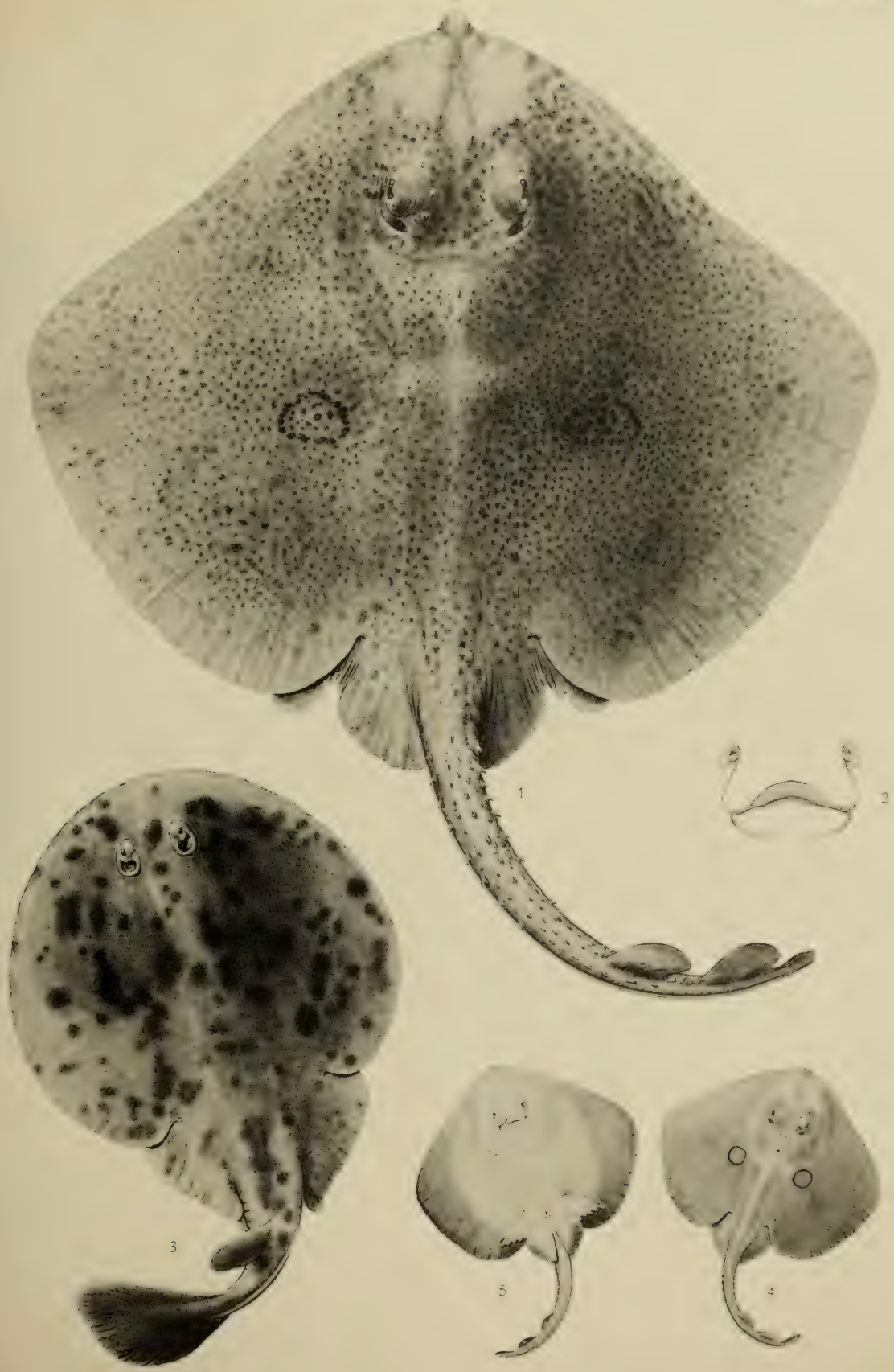
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PLATE 25.

PLATE 25.

RAIIDAE and NARCACIONTIDAE.

Fig. 1. RAIA SENTA (Page 338). Fig. 2. NARCACION NOBILIANUS (Page 310).

1. Dorsal view of a specimen $22\frac{1}{2}$ inches long. M. C. Z. 250.
2. Dorsal view.

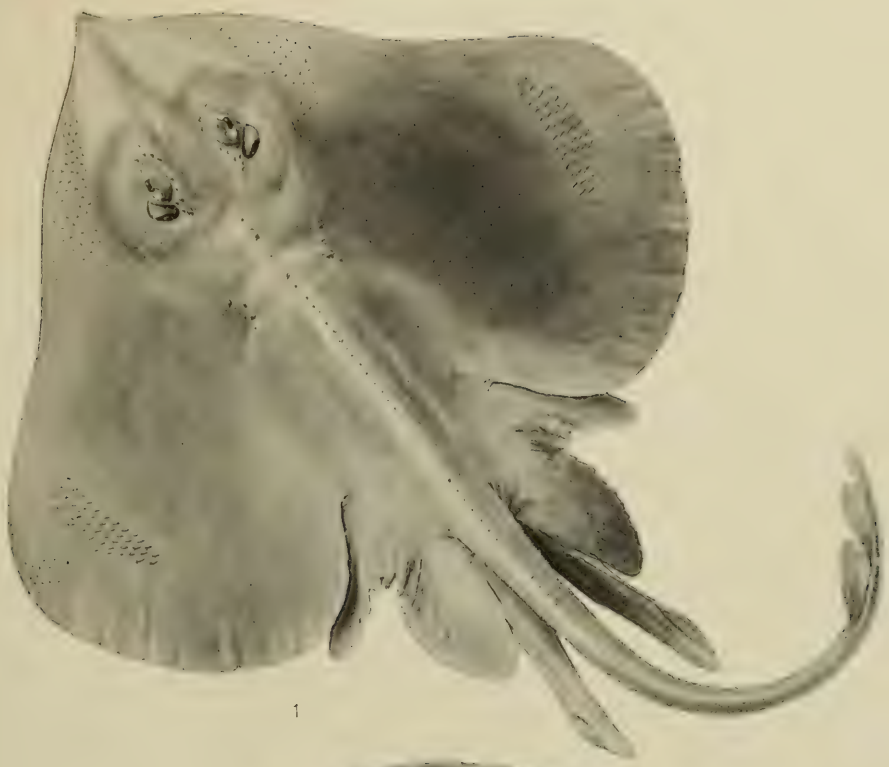

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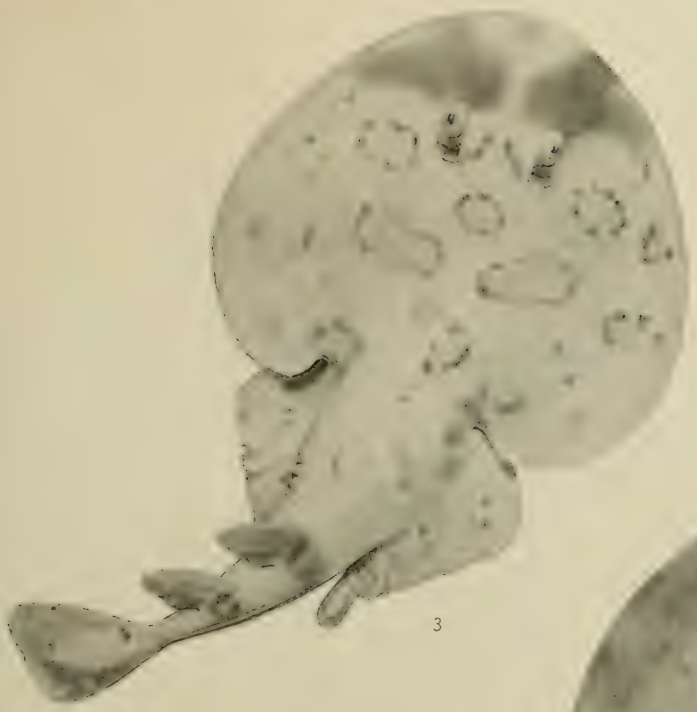
PLATE 26.

PLATE 26.

NARCACIONTIDAE.

Fig. 1. NARCINE BRASILIENSIS (Page 297). Fig. 2. NARCINE BRASILIENSIS BANCROFTI (P
298). Fig. 3. NARCINE BRASILIENSIS CORALLINA (Page 298).

1. Dorsal view of a specimen $14\frac{3}{8}$ inches long. M. C. Z. 655.
2. Dorsal view of a specimen $9\frac{1}{8}$ inches long. M. C. Z. 752.
3. Dorsal view of a specimen $7\frac{7}{8}$ inches long. M. C. Z. 44.



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HELIOTYPE CO.

PLATE 27.

PLATE 27.

RAIIDAE.

Fig. 1–2. Sympterygia acuta (Page 370). Fig. 3–5. Malacorhina mira (Page 372).

1. Dorsal view of a specimen 13½ inches long. M. C. Z. 632.
2. Ventral view of the anterior half of disk.
3. Dorsal view of a specimen 14¾ inches long. M. C. Z. 226.
4. Ventral view of the anterior part of disk.
5. Dorsal and lateral views of the produced end of the snout.

PLATE 28.

PLATE 28.

DASYBATIDAE.

Fig. 1–3. UROBATIS SLOANI. (Page 402).

1. Dorsal view.
2. Lateral view of young from oviduct.
3. Ventral view of young from oviduct.

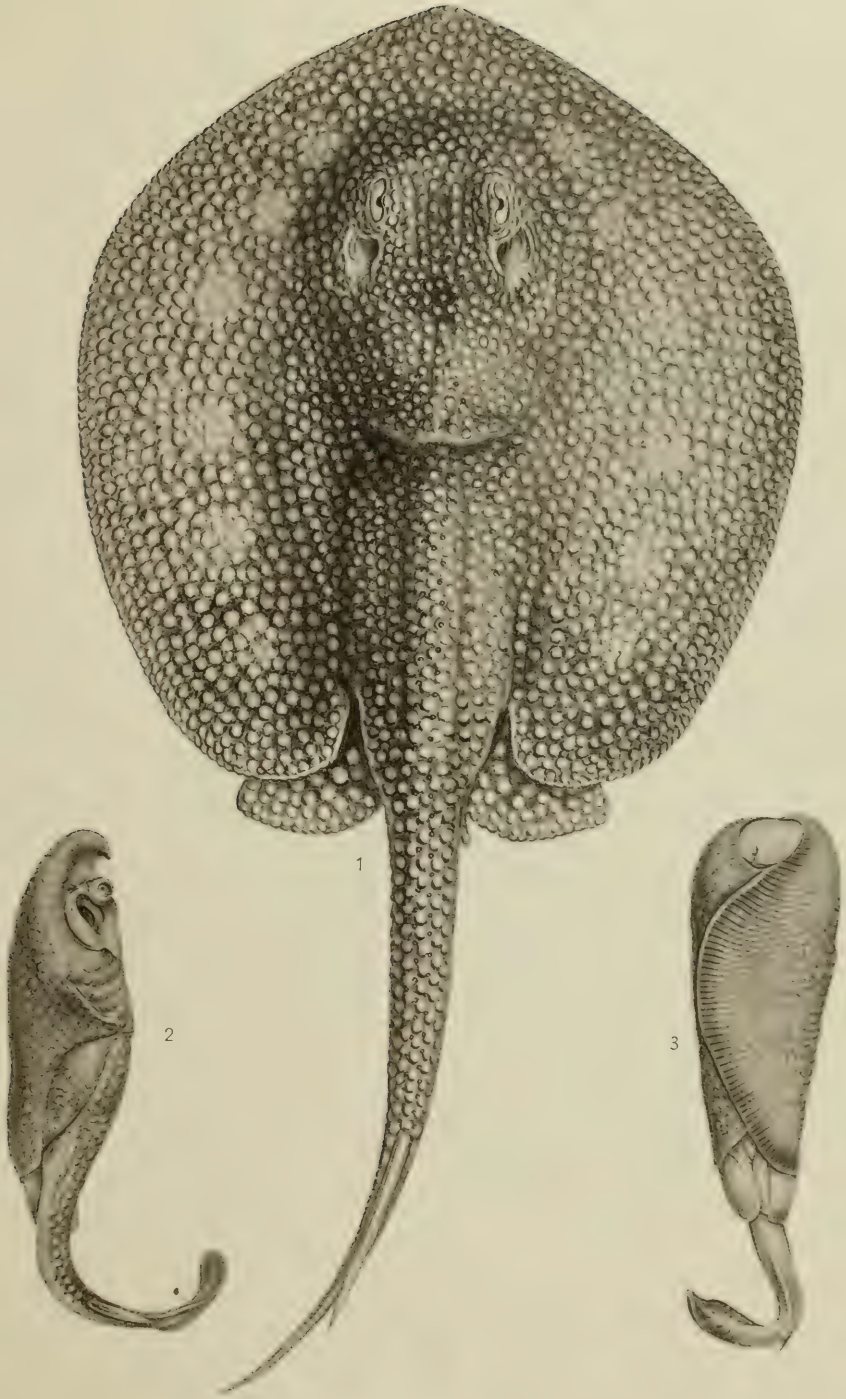
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PLATE 29.

PLATE 29.

DASYBATIDAE.

Fig. 1–2. UROBATIS VERMICULATUS (Page 402).

1. Dorsal view. M. C. Z. 1055.
2. Ventral fins and tail from below.

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PLATE 30.

PLATE 30.

DASYBATIDAE.

Fig. 1–2. UROTRYGON MUNDUS (Page 406).

1. Dorsal view of a specimen 8¼ inches long. M. C. Z. 831.
2. Ventral view.

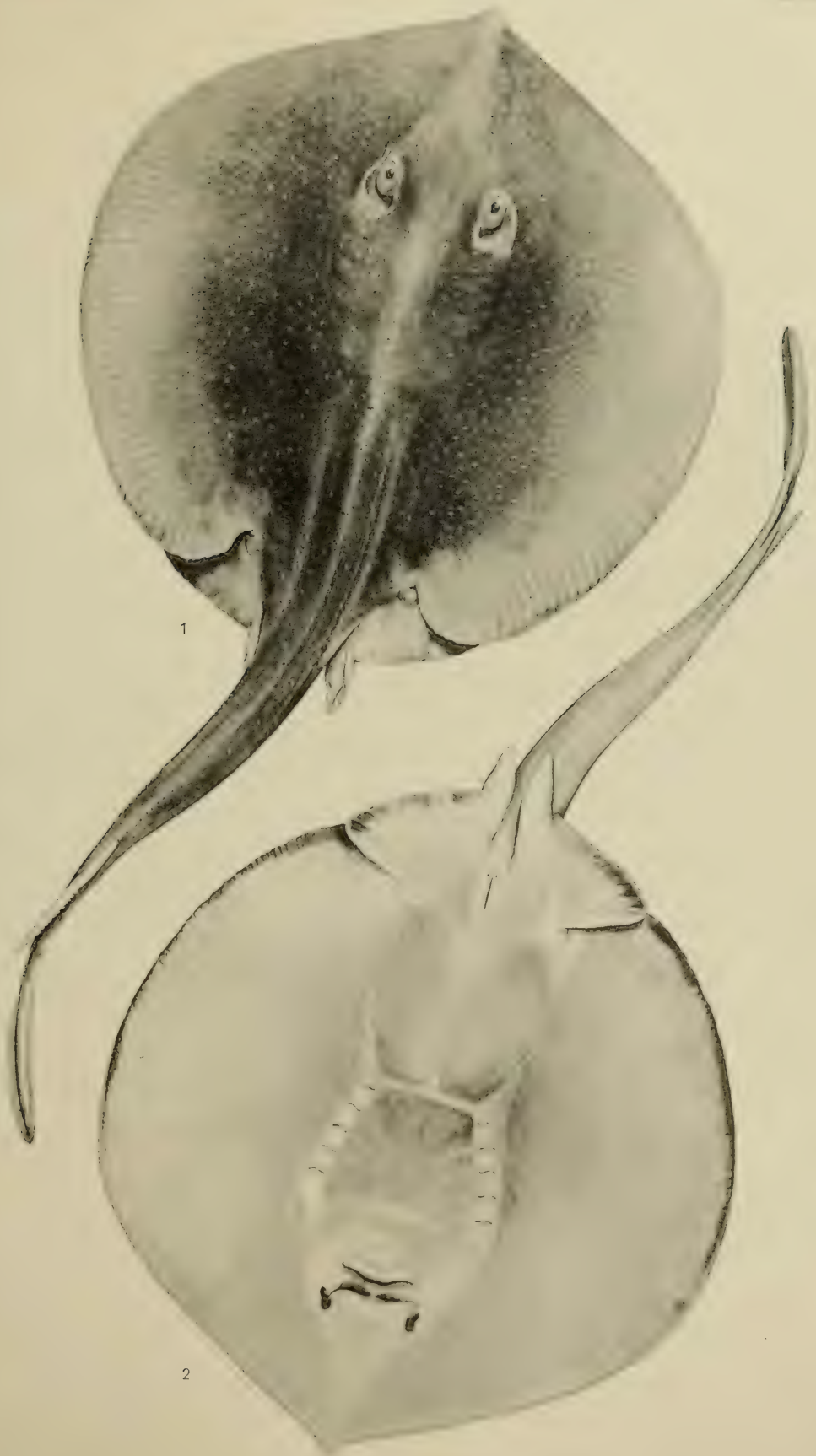

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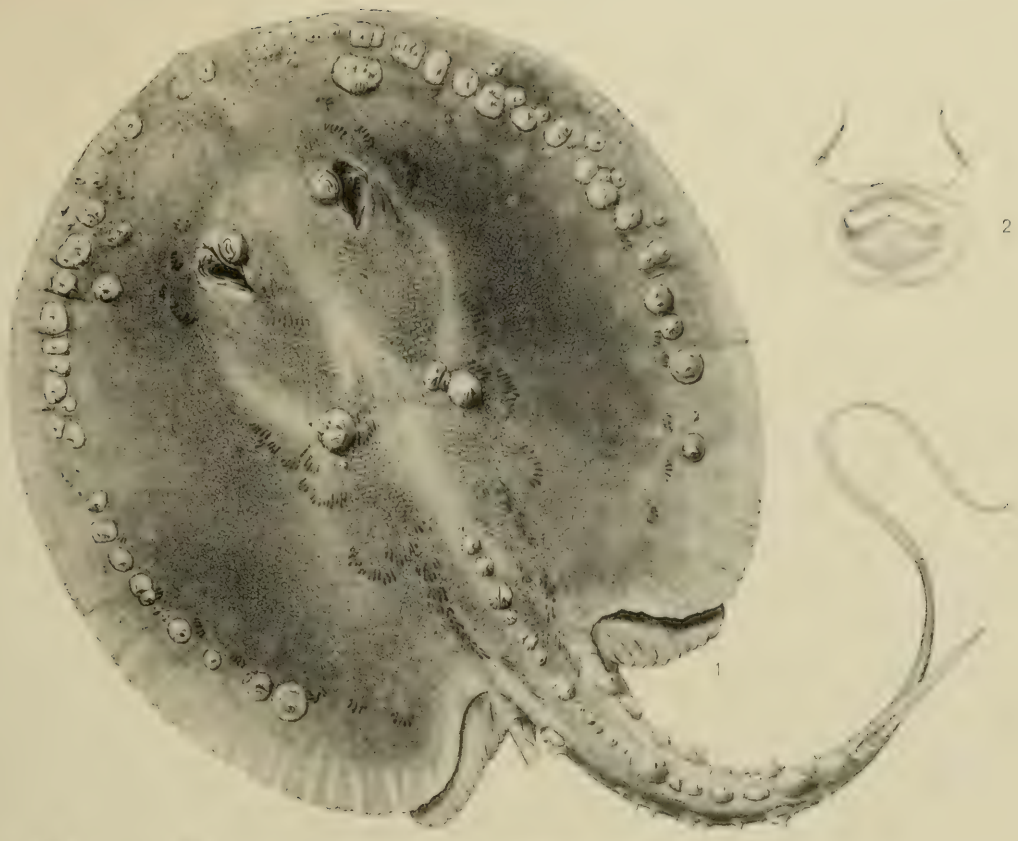
PLATE 31.

PLATE 31.

POTAMOTRYGONIDAE.

Fig. 1–2. Potamotrygon circularis (Page 419). Fig. 3–4. Potamotrygon laticeps (Page 417).

1. Dorsal view. Disk 15¼ inches long. M. C. Z. 291.
2. Mouth and nostrils.
3. Dorsal view. Disk 16 inches long. M. C. Z. 605.
4. Mouth and nostrils.



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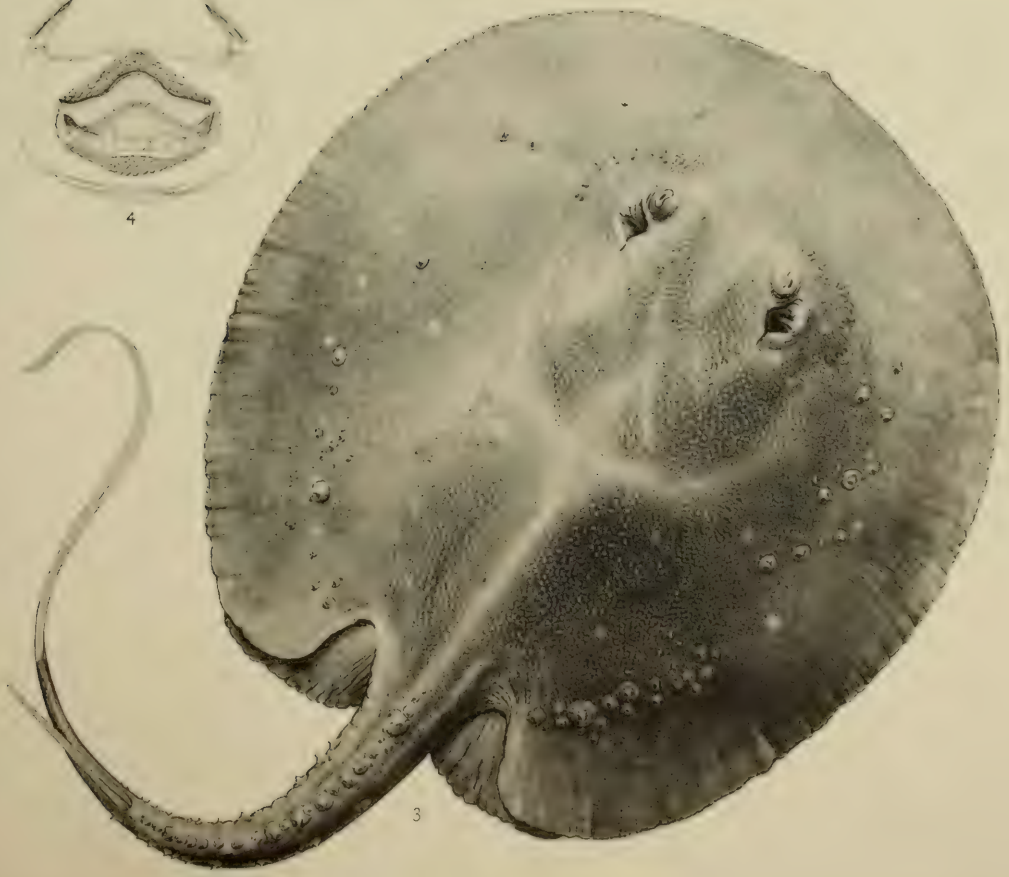

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PLATE 32.

PLATE 32.

DASYBATIDAE.

Fig. 1–2. Dasybatus latus (Page 383). Fig. 3–4. Dasybatus longus (Page 390). Fig. 5-6. Dasybatus brevis (Page 396).

1. Dorsal view of a specimen 51 inches long. M. C. Z. 129.
2. Mouth and nostrils.
3. Dorsal view of a specimen $39\frac{1}{4}$ inches long. M. C. Z. 126.
4. Mouth and nostrils.
5. Dorsal view of a specimen $30\frac{7}{8}$ inches long. M. C. Z. 371.
6. Mouth and nostrils.

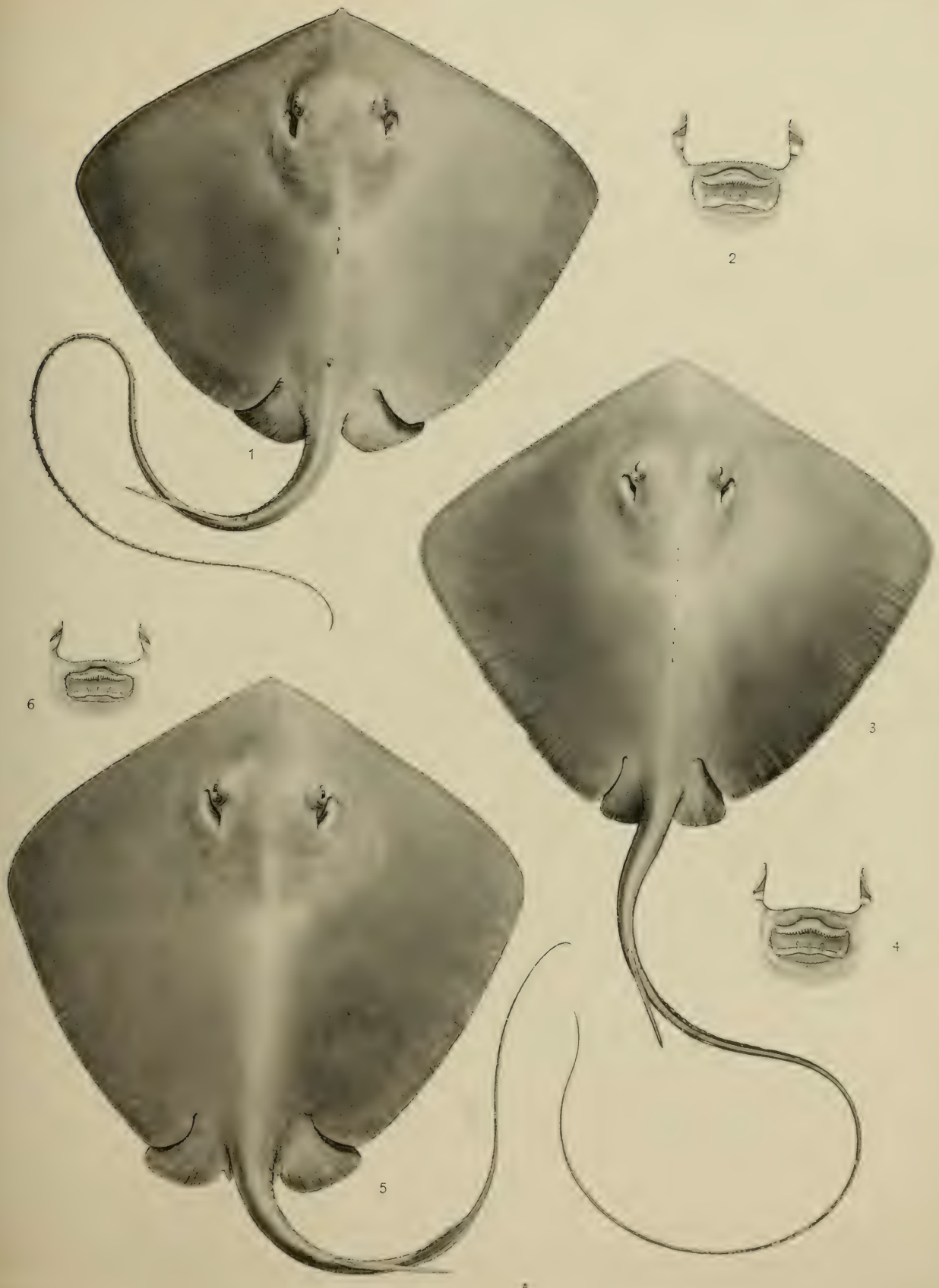

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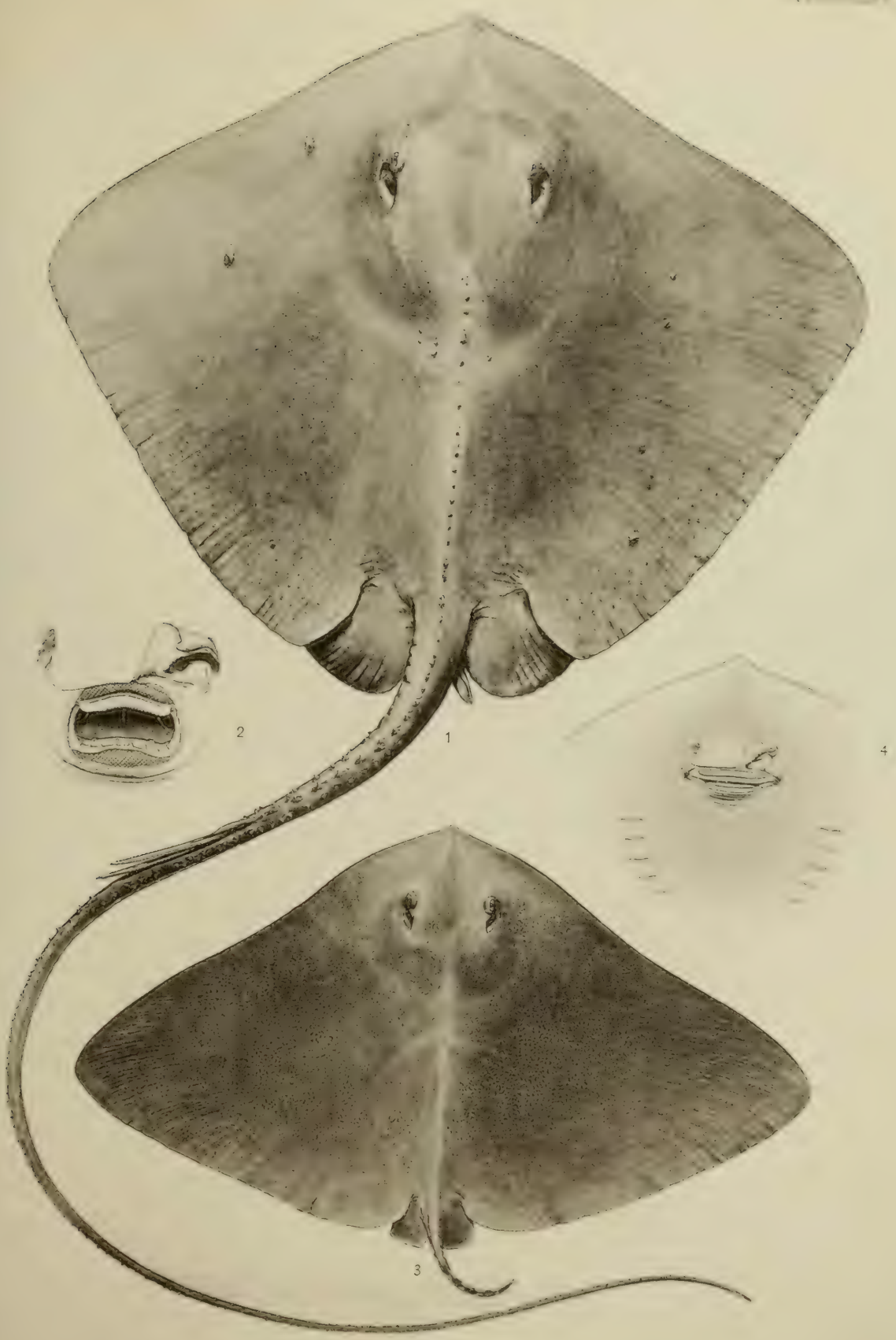
PLATE 33.

PLATE 33.

DASYBATIDAE.

Fig. 1–2. Dasybatus marinus (Page 382). Fig. 3–4. Pteroplatea micrura (Page 414).

1. Dorsal view of a specimen 106 inches long. M. C. Z. 990.
2. Mouth and nostrils.
3. Dorsal view of a specimen 11½ inches long. M. C. Z. 95.
4. Head from below.



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HELIOTYPE CO.

PLATE 34.

PLATE 34.

POTAMOTRYGONIDAE.

Fig. 1–3. Disceus thayeri (Page 426).

1. Dorsal view. Disk $12\frac{7}{8}$ inches long. M. C. Z. 563.
2. Mouth and nostrils.
3. Teeth from near the front end of the jaw.

PLATE 35.

PLATE 35.

MYLIOBATIDAE.

Fig. 1–4. Myliobatis freminvillii (Page 432).

1. Dorsal view of a specimen 46⅛ inches long. M. C. Z. 992.
2. Frontal view.
3. Ventral view.
4. Teeth from upper and lower jaws.

HELIOTYPE CO.

PLATE 36.

PLATE 36.

MYLIOBATIDAE.

Fig. 1–3. AETOMYLAEUS MACULATUS (Page 435). Fig. 4–6. MYLIOBATIS PERUVIANUS (Page 430).

1. Dorsal view of a specimen $28\frac{1}{2}$ inches long. M. C. Z. 106.
2. Head from below.
3. Teeth from upper and lower jaws.
4. Dorsal view of a specimen $23\frac{5}{8}$ inches long. M. C. Z. 636.
5. Head from below.
6. Teeth from upper and lower jaws.

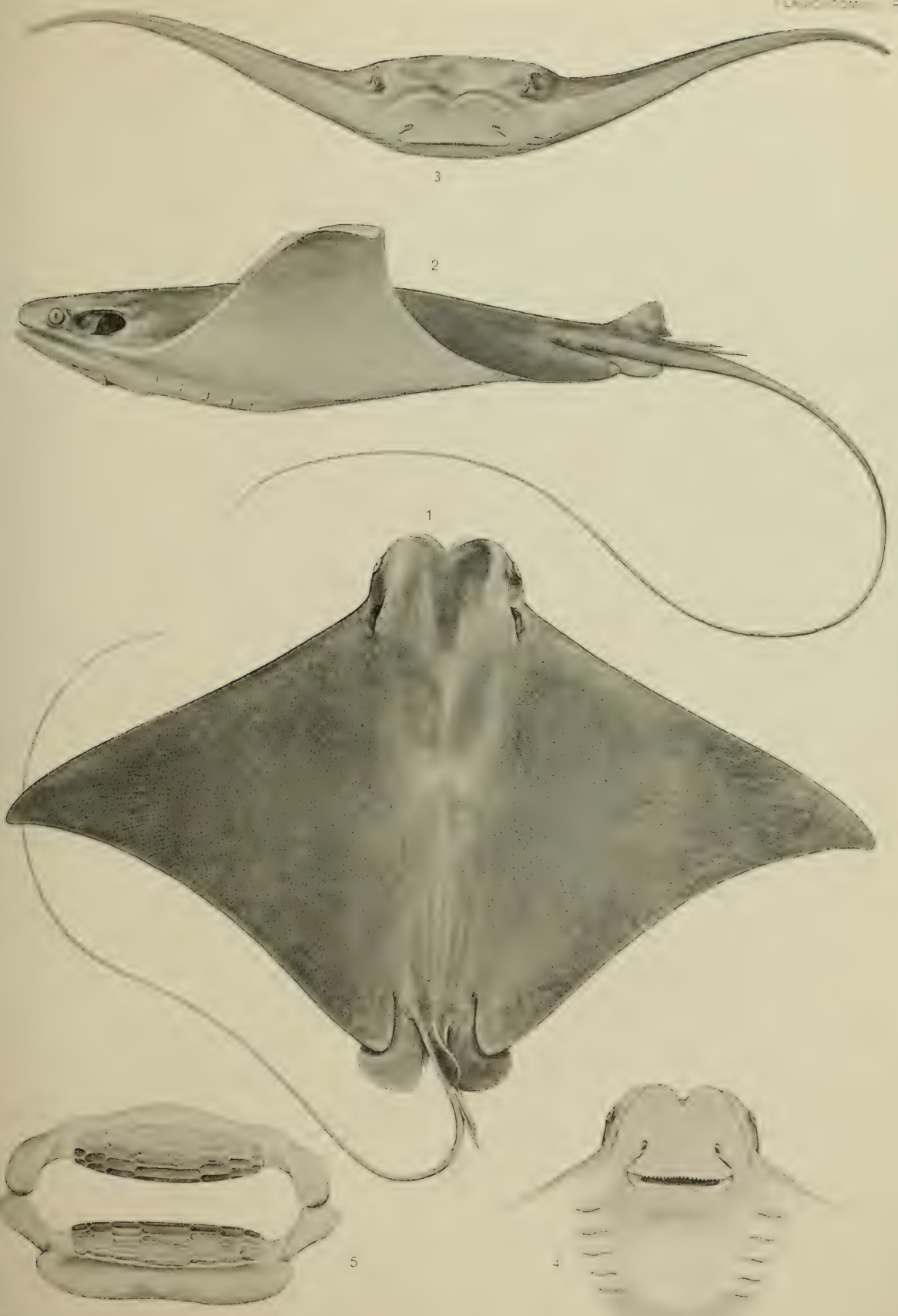
PLATE 37.

PLATE 37.

RHINOPTERIDAE.

Fig. 1–3. Rhinoptera quadriloba (Page 444).

1. Dorsal view of a specimen 38½ inches long. M. C. Z. 746.
2. Lateral view.
3. Frontal view.



HELIOTYPE CO.

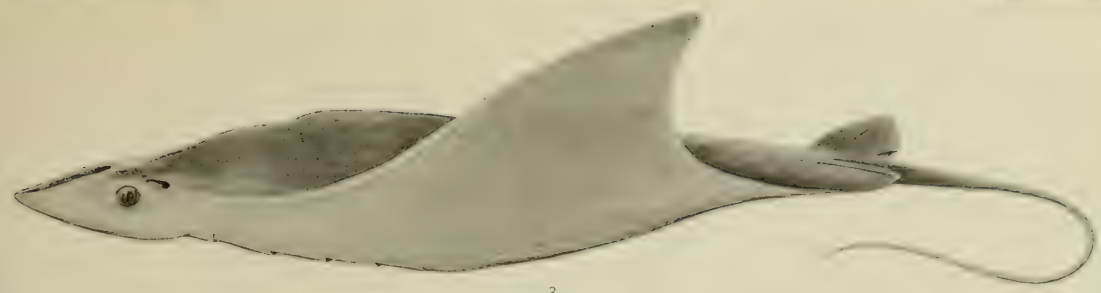
PLATE 38.

PLATE 38.

MOBULIDAE.

Fig. 1–6. Mobula hypostoma (Page 453).

1. Dorsal view of a specimen 39 inches long. M. C. Z. 683.
2. Frontal view.
3. Lateral view.
4. Head and gill openings from below.
5. Teeth from upper jaw.
6. Teeth from lower jaw.



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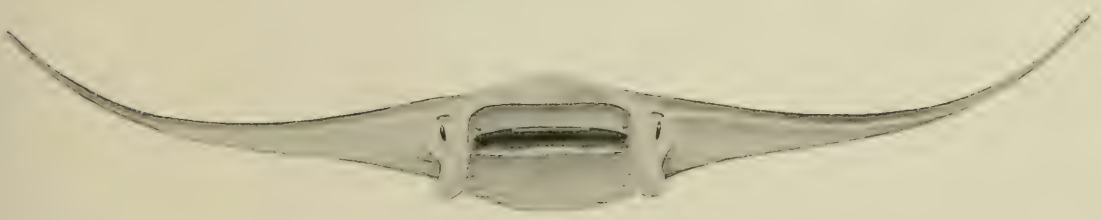

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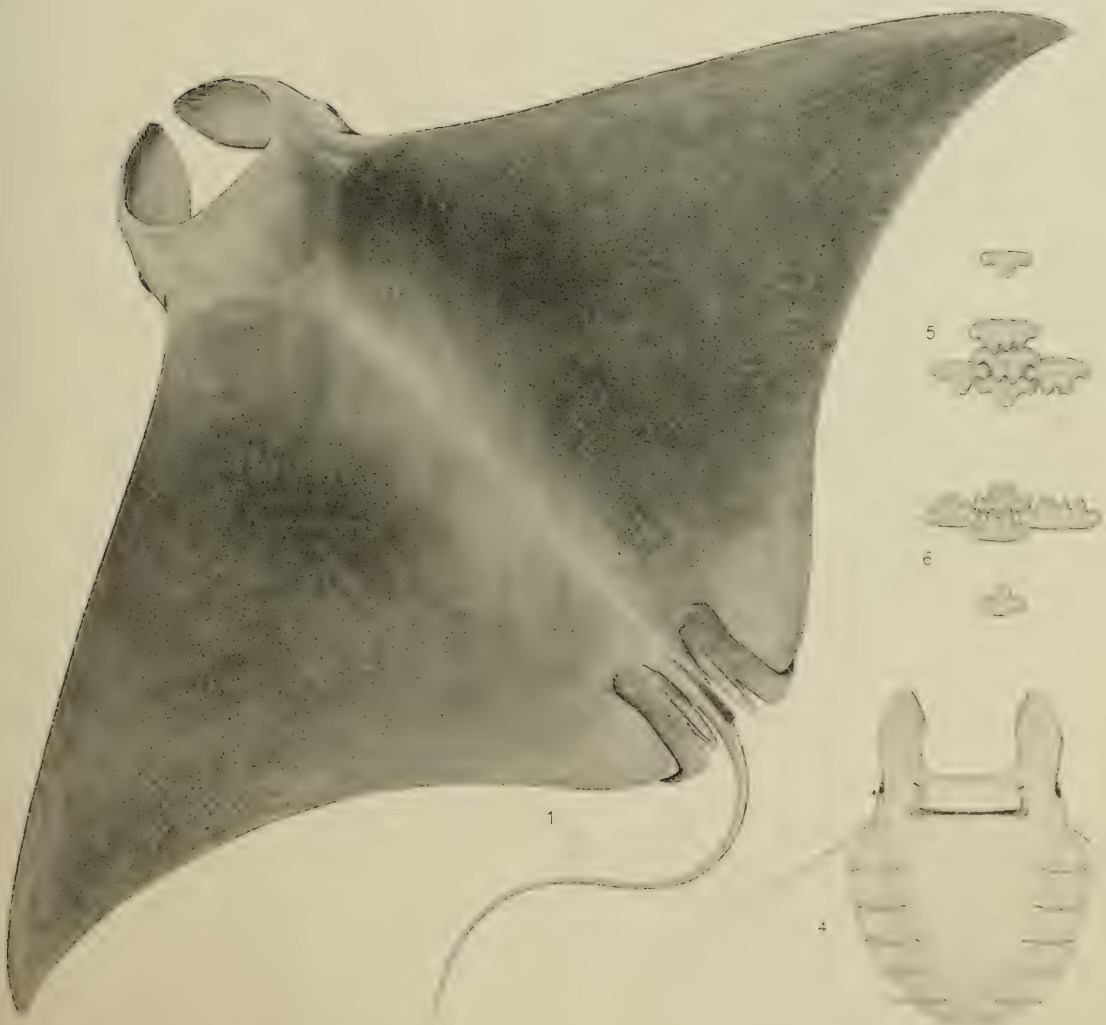

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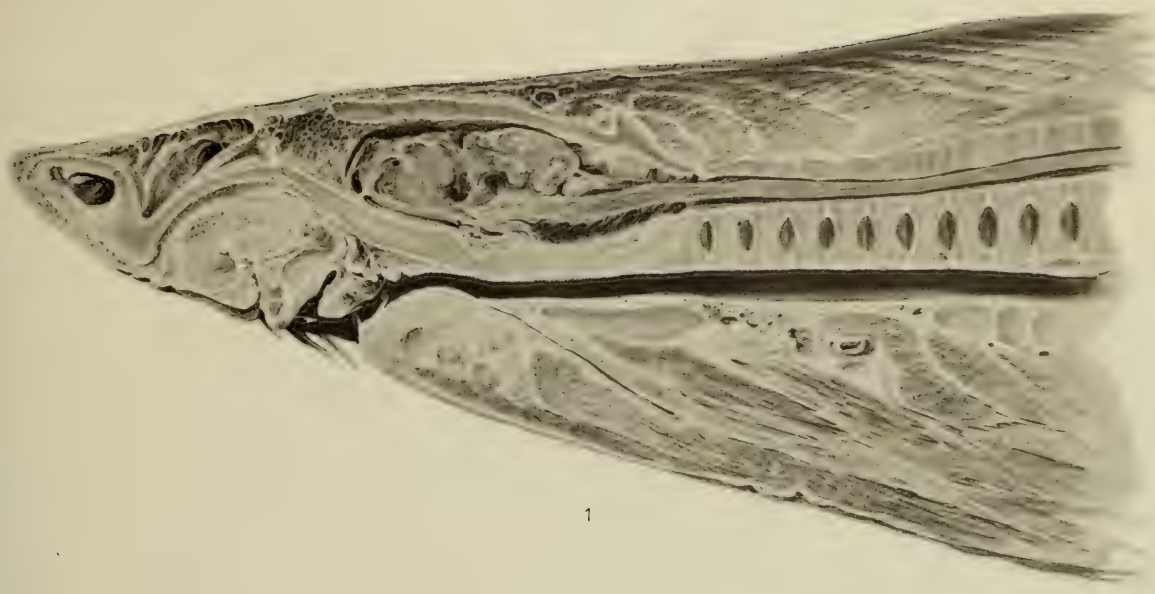
PLATE 39.

PLATE 39.

CARCHARIDAE and MYLIOBATIDAE.

Fig. 1. Carcharias taurus (Page 25). Fig. 2. Myliobatis freminvillii (Page 432).

These longitudinal sections of the head and anterior part of the body contrast the conditions in one of the lower of the Antacea with those in one of the most specialized of the Platosomia. The sections show the cartilages of the skull, those of the forward portion of the vertebral column, and in part those of the branchial apparatus; they show the brain, its chamber, the celular cavities of the head, the mouth cavities from the lips to the stomach, the jaws, the teeth, the pads protecting the roof of the mouth, and the arrangement of the muscles.



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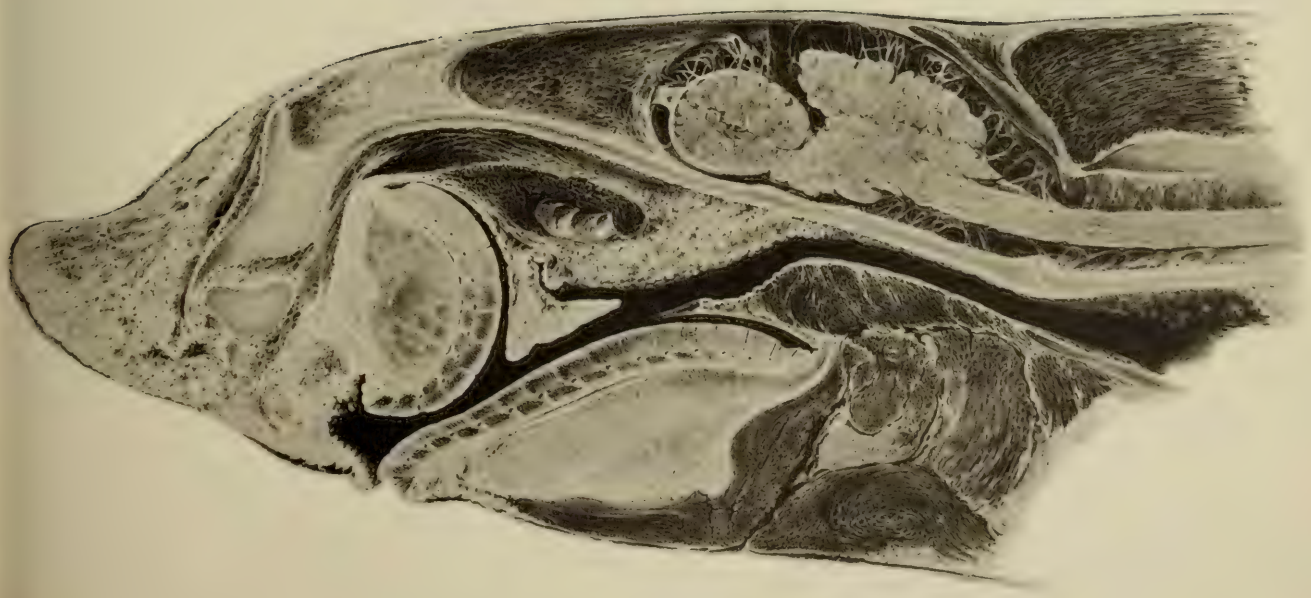

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PLATE 40.

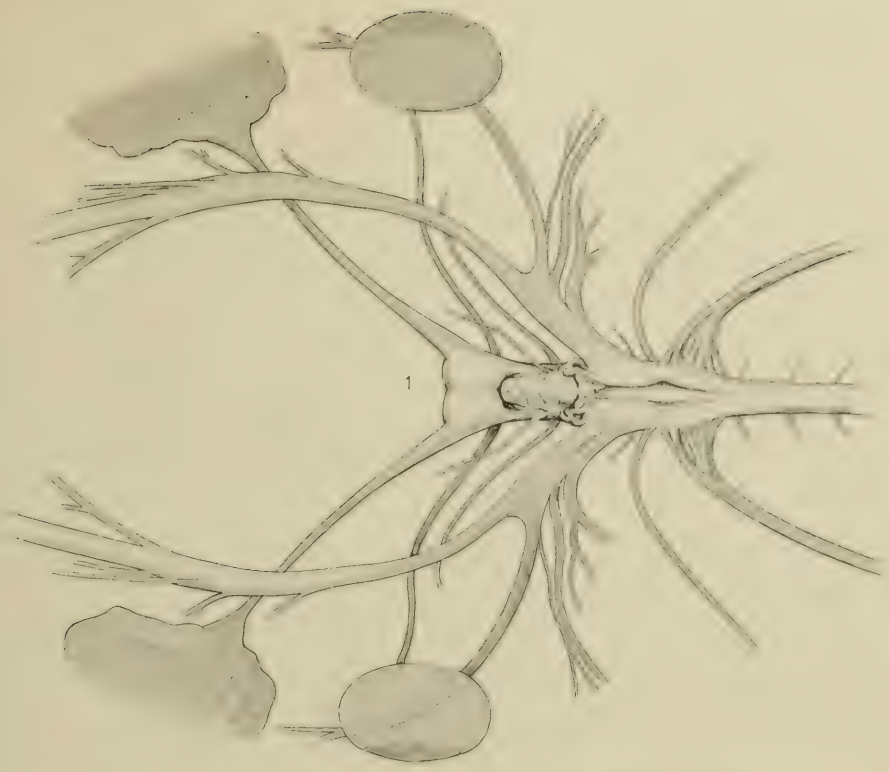
PLATE 40.

CARCHARIDAE.

Fig. 1–3. Scapanorhynchus owstoni. M. C. Z. 1048 (Page 28).

1. Brain from above.
2. Brain from the side.
3. Brain from below.

Comparison of the brain of this species with that of *Carcharias taurus*, Plate **41**, proves that Scapanorhynchus is the more primitive of the two genera and conversely that Carcharias is much the more advanced.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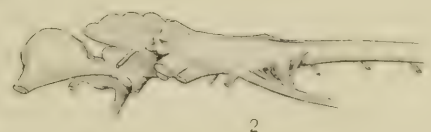
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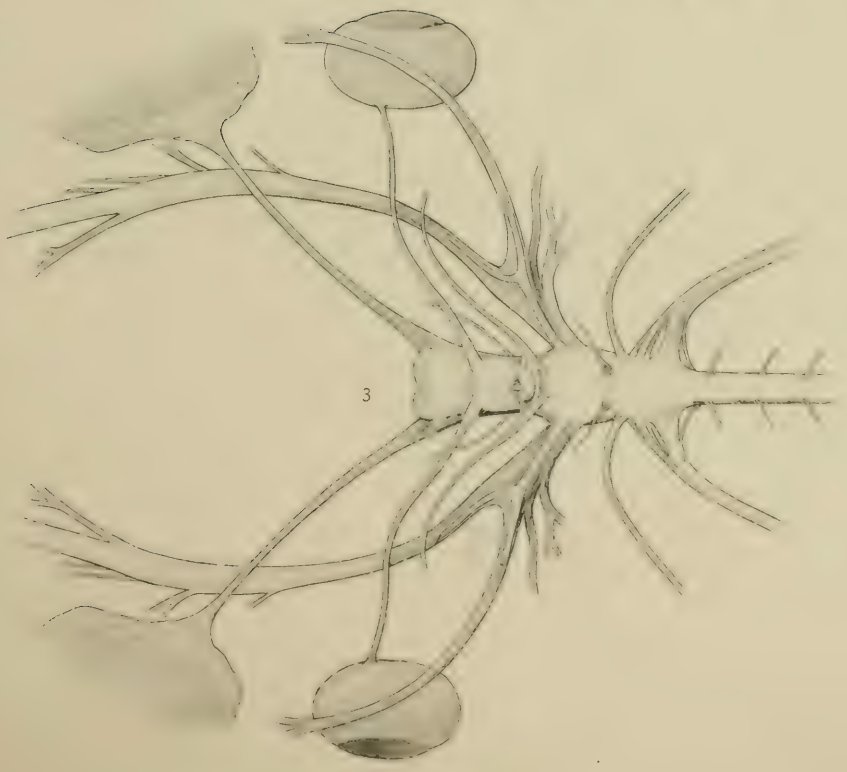
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PLATE 41.

PLATE 41.

CARCHARIDAE.

Fig. 1–3. CARCHARIAS TAURUS (Page 25).

1. Upper surfaces of the brain.
2. Brain from the side.
3. Brain from below.

Though not of as high a type as that of Vulpecula, Plate **42**, and greatly outranked by the brains of the Carcharinidae and Cestraciontidae, Plate **43**, fig. 1–4, the brain of *Carcharias taurus* makes a considerable advance from that of Scapanorhynchus, Plate **40**.

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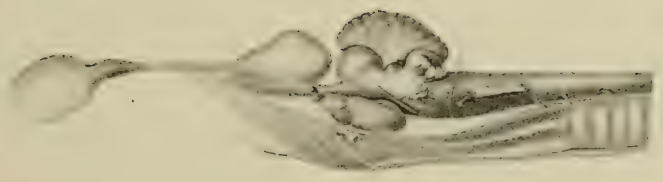

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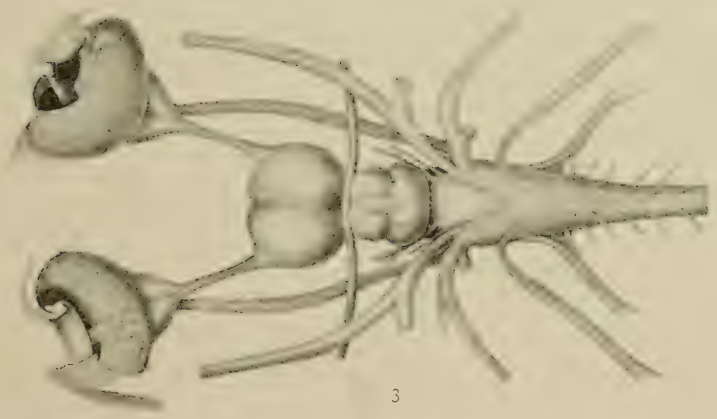

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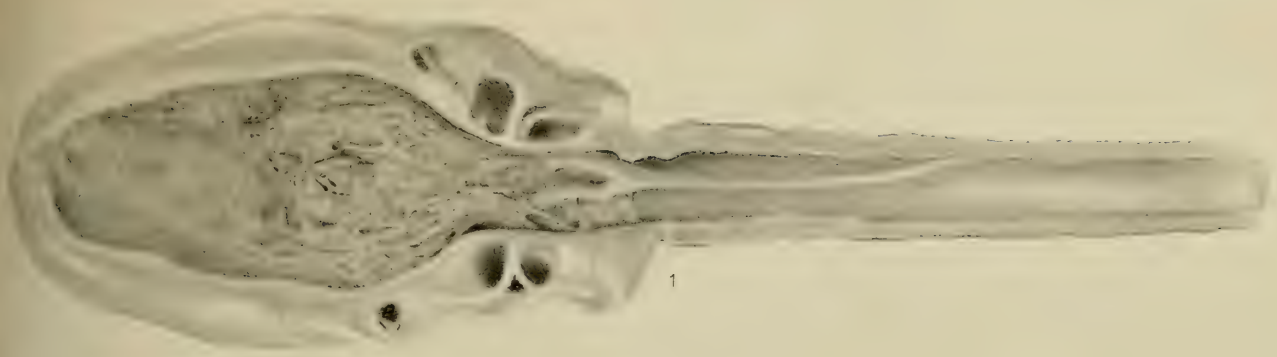
PLATE 42.

PLATE 42.

VULPECULIDAE.

Fig. 1–5. Vulpecula marina (Page 30).

1. Brain after removal of the cartilage above it.
2. Brain after partial removal of the vessels and envelopes.
3. Lower surface of the brain removed from its chamber.
4. Brain from above.
5. Brain from the side.



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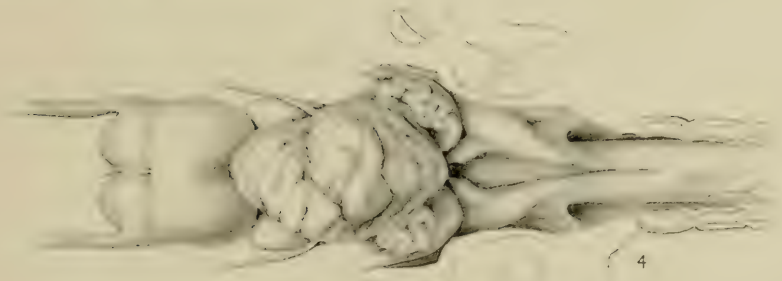

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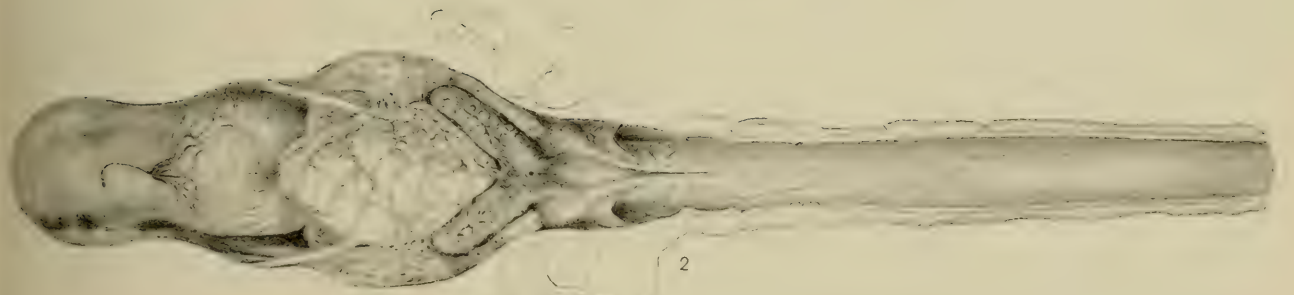

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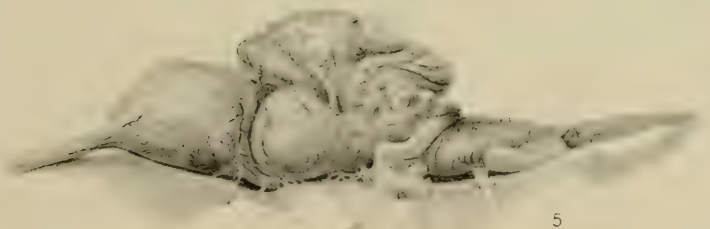

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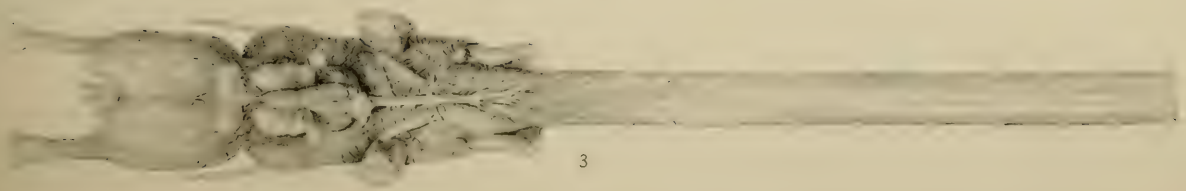

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PLATE 43.

PLATE **43**.

CESTRACIONTIDAE, CARCHARINIDAE, and SQUALIDAE.

Fig. 1. Cestracion tiburo (Page 160). Fig. 2–3. Cestracion zygaena (Page 157). Fig. 4- Carcharinus platyodon (Page 126). Fig. 6–8. Galeocerdo arcticus (Page 148). Fig. 9–1 Squalus acanthias (Page 192).

1. Dorsal view of brain. M. C. Z. 1292.
2. Dorsal view of brain. M. C. Z. 1291.
3. Ventral view of brain.
4. Dorsal view of brain.
5. Nasal sac, bisected.
6. Dorsal view of brain. M. C. Z. 1288.
7. Ventral view of brain.
8. Lateral view of brain.
9. Dorsal view of brain. M. C. Z. 1298.
10. Ventral view of brain.

From the brain of the Carcharidae, Plates **40** and **41**, there was in the Vulpeculidae, Plate **42** marked increase in the plication of the hind brain with a less considerable one in the size of the fore br In Plate **43**, the much greater advance of the Cestraciontidae is seen both in the volume of the fore br and the complexity of the hind brain; these are more advanced in the Cestraciontidae than in Carcharinidae, the nearest allies, for instances see fig. 4, *Carcharinus platyodon*, and figs. 6–8, *Galeoce arcticus*. That the archaic family Squalidae is much lower in rank is indicated by the smooth h brain and the smaller amount of the fore brain.

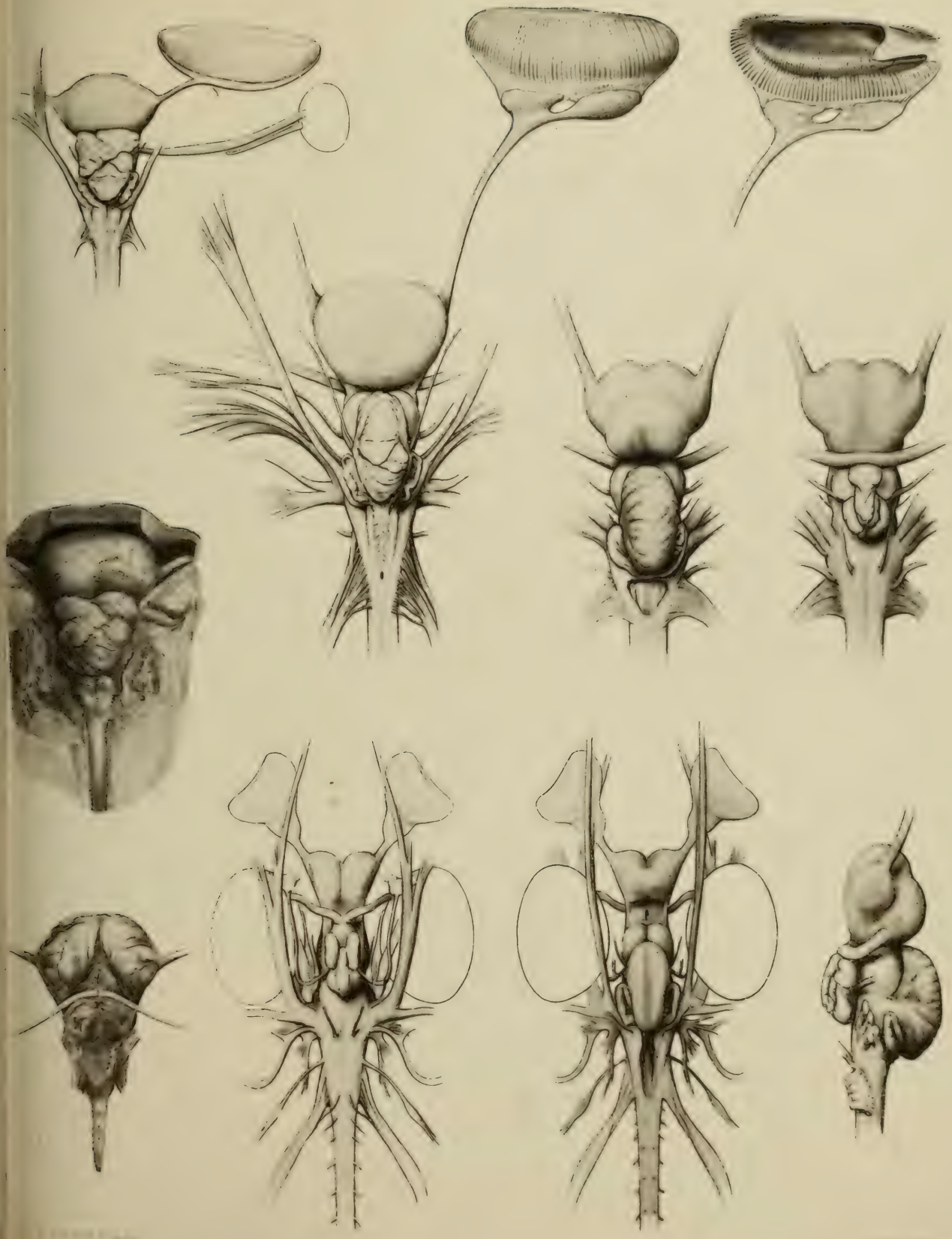

PLATE 44.

PLATE 44.

RAIIDAE and DASYBATIDAE.

Fig. 1–3. RAIA SCABRATA (Page 340). Fig. 4–6. RAIA STABULIFORIS (Page 341). Fig. 7. DASYBATUS MARINUS (Page 382).

1. Brain from above. M. C. Z. 1289.
2. Brain from the side.
3. Brain from below.
4. Brain from above. M. C. Z. 1294.
5. Ear from the side.
6. Brain from below.
7. Brain from above. M. C. Z. 1287.

The comparative amount of the brain is much the same in these families but the higher rank of the Dasybatidae is plainly indicated in the greater complexity of the hind brain.

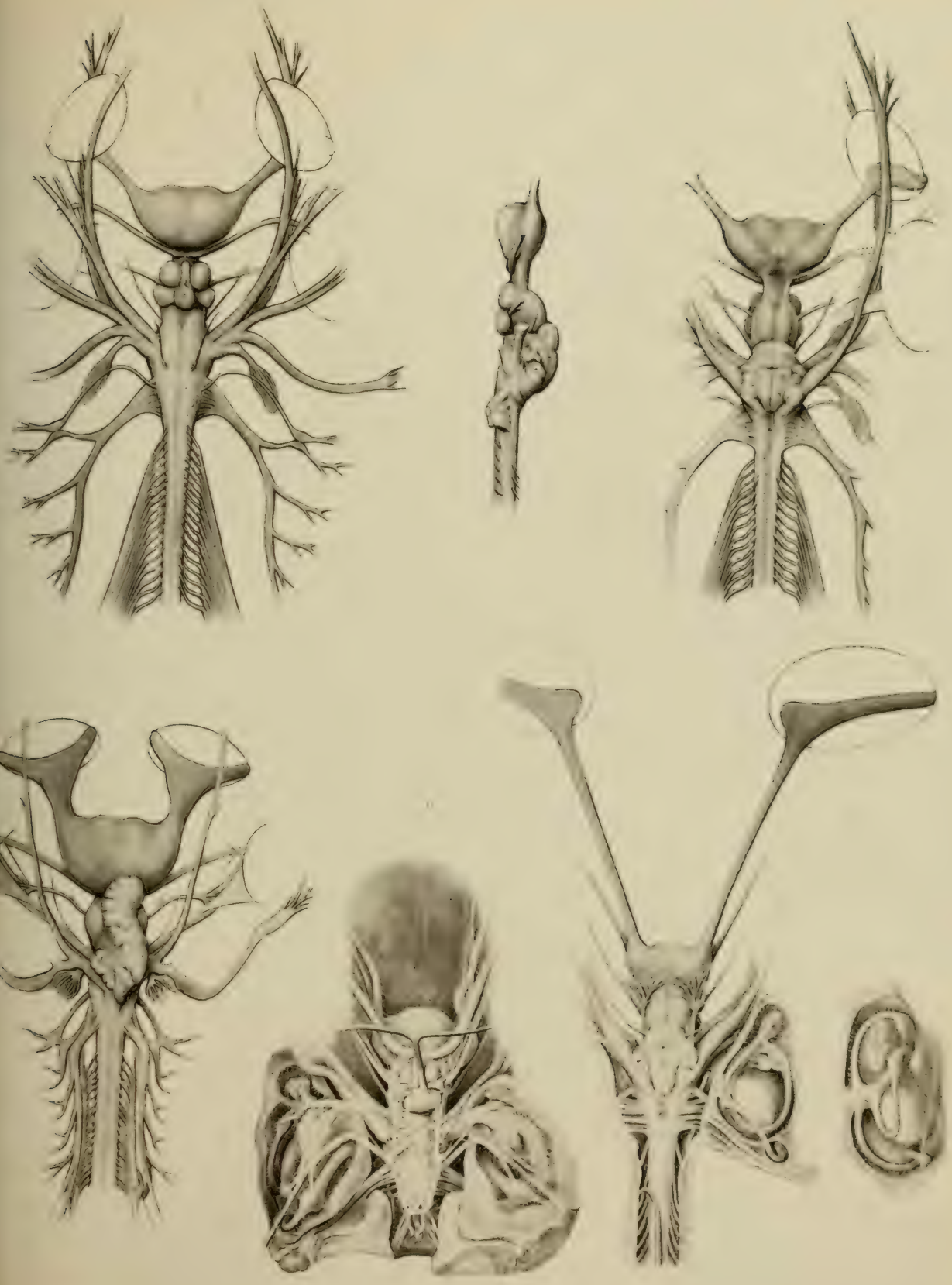

PLATE 45.

PLATE 45.

CENTRACIONTIDAE.

Fig. 1–6. CENTRACION FRANCISCI (Page 186).

1. Teeth and jaws of a very young specimen.
2. Upper jaws and teeth of the same.
3. Lower jaws and teeth of the same.
4. Jaws and teeth of a larger specimen.
5. Upper jaws and teeth of the same.
6. Lower jaws and teeth of the same.

The teeth of the very young Centracion are all raptorial; they attest a soft-bodied food at this stage, and a probable ancestry in forms with cuspidate teeth. The larger specimen shows the widening of the hindmost teeth in preparation for the development of the grinders.

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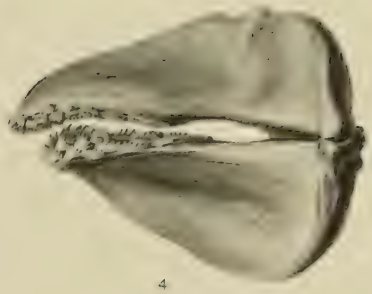

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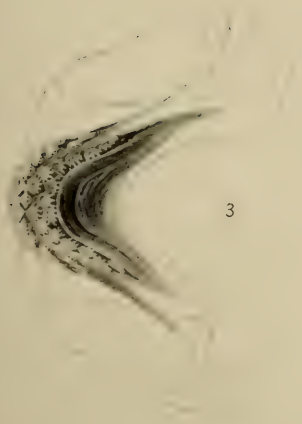

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PLATE 46.

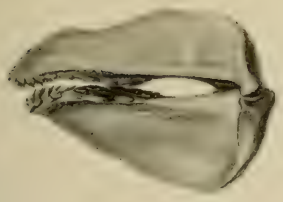
PLATE 46.

CENTRACIONTIDAE.

Fig. 1–6. CENTRACION FRANCISCI (Page 186).

1. Jaws of a specimen of medium size.
2. Upper jaws and teeth of the same.
3. Lower jaws and teeth of the same.
4. Jaws of an old individual.
5. Upper jaws and teeth of the same.
6. Lower jaws and teeth of the same.

These figures are from older specimens than those shown on Plate **45**. They indicate the decided change that takes place in the feeding habits. The hinder teeth are all molars, with a low ridge instead of cusps, and are much wider and more swollen than the front teeth, some of the hindmost of which apparently have been succeeded, when renewed, by molars in their particular rows.



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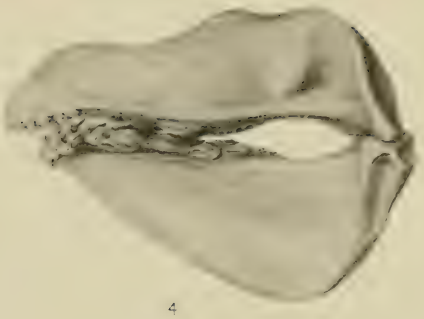

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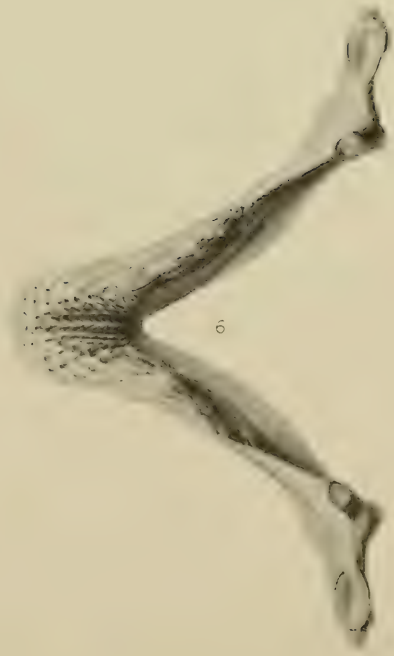

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PLATE 47.

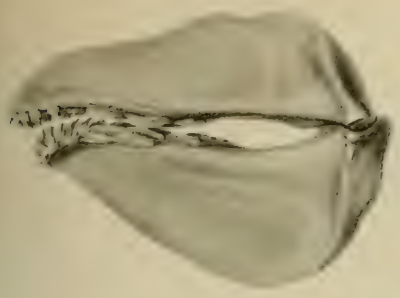
PLATE 47.

CENTRACIONTIDAE.

Fig. 1–3. Centracion quoyi (Page 187). Fig. 4–6. Centracion philippi (Page 182).

1. Lateral view of jaws and teeth.
2. Upper teeth and jaws from below.
3. Lower teeth and jaws from above.
4. Lateral view of jaws and teeth.
5. Upper teeth and jaws from below.
6. Lower teeth and jaws from above.

The ridges on the molars of younger specimens become less prominent with age and use. The harder the food in particular localities the more faint the ridges appear.



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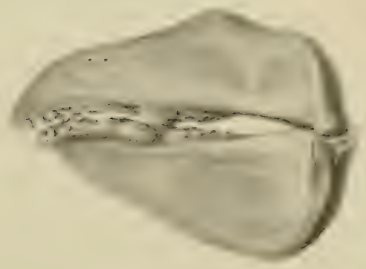

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HELIOTYPE CO.

PLATE 48.

PLATE 48.

RHINOPTERIDAE.

Fig. 1–3. Rhinoptera jussieui (Page 447). Fig. 4. Rhinoptera marginata (Page 445). Fig. 5–6. Rhinoptera lalandii (Page 445).

1. Teeth from a very young specimen. M. C. Z. 311.
2. Teeth from a larger specimen. M. C. Z. 316.
3. Teeth from a large specimen. M. C. Z. 535.
4. Jaws and primary dentition. M. C. Z. 631.
5. Teeth from a medium sized specimen. M. C. Z. 534.
6. Teeth from a large specimen. M. C. Z. 534.

Figures 1, 2, and 4 illustrate the changes in dentition during the period of rapid growth from very young stages. The small round primary teeth in front of the pavements suggest derivation from ancestral forms with dentition resembling that of some Dasybatidae. In fig. 3 and 6 are shown the teeth of large specimens. Figures 3 and 5 show dentition that have been much affected by individual variation.

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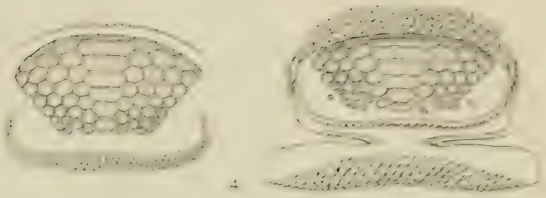

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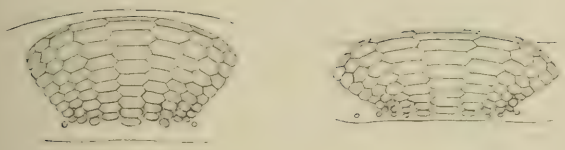

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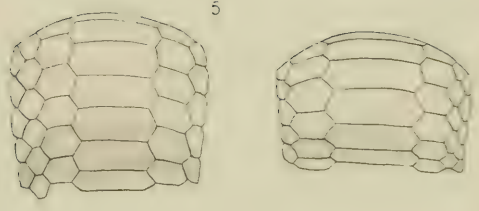

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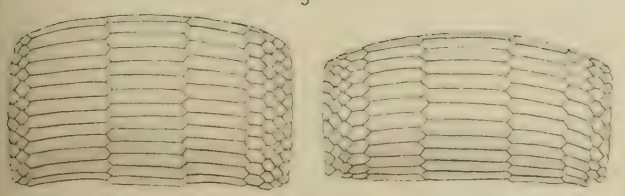

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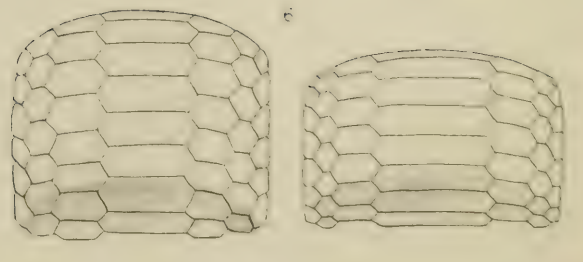


PLATE 49.

PLATE 49.

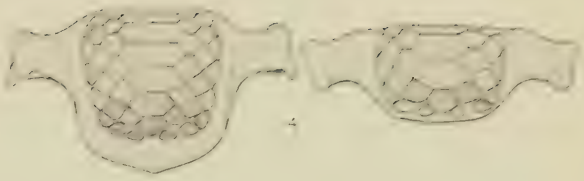
MYLIOBATIDAE.

Fig. 1–3. Aëtobatus narinari (Page 441). Fig. 4–6. Myliobatis californicus (Page 429).

1. Dentition of a very young specimen. M. C. Z. 1079.
2. Dentition of a young specimen, larger than that shown in fig. 1. M. C. Z. 1070.
3. Teeth of a large specimen. M. C. Z. 865.
4. Dentition of a very young specimen. M. C. Z. 348.
5. Dentition of a larger specimen. M. C. Z. 395.
6. Dentition of a specimen beyond the age of rapid growth. M. C. Z. 424.

In the youngest specimens of Aëtobatus examined there are two rows of upper and two rows of lower teeth, fig. 1 and 2, each two quickly broadening and being succeeded by the broad teeth of the single row retained through life. Possibly a still earlier stage may show a dentition more like that of Rhinoptera in its primary features. The earliest stage of Myliobatis figured has six rounded teeth in front of the pavement, another has seven, thus accounting for all the rows of later stages, the median one only becoming broad. It is to be expected that younger specimens will show dentitions more in accord with that of fig. 1, Plate 48, in Rhinoptera.

1



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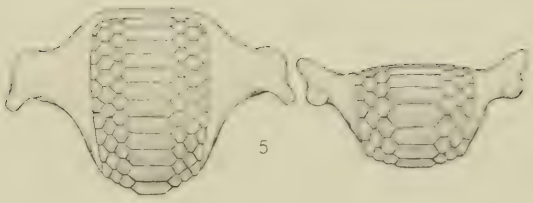

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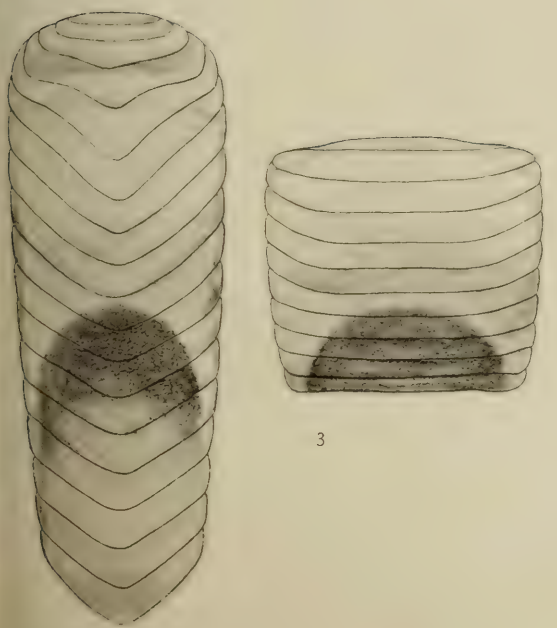

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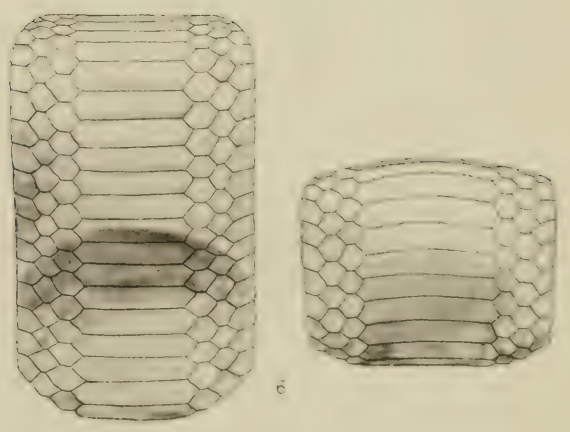

6

E. N. FISCHER, DEL.

HELIOTYPE CO.

PLATE 50.

PLATE 50.

ANTACEA.

Fig. 1, 6, 8. Galeorhinus laevis (Page 176). Fig. 2. Parmaturus pilosus (Page 89). Fig. 3 Triaenodon obesus (Page 163). Fig. 4. Carcharinus milberti (Page 133). Fig. 5, 11, 12. Triaki semifasciata (Page 165). Fig. 7. Triakis henlei (Page 168). Fig. 9. Hemigaleus pectorali (Page 150). Fig. 10. Eugaleus galeus (Page 153). Fig. 13–16. Scoliodon longurio (Page 114)

The nictitating membrane in its early stages is merely a longitudinal fold in the lower eyelid, no reaching the edges of the lid, fig. 1 and 2. This is the case in the very young of *Galeorhinus laevis*, fig. 1 in older specimens of this species the fold reaches the edge of the lid at one end, as in fig. 6, but in larg ones the fold reaches the edge of the lid at both ends, fig. 8, and in transverse section its outlines resembl those of Triakis, fig. 12. The membrane attains its greatest perfection and more nearly covers the eye ball in the Cestraciontidae (Hammer Heads) and in the Carcharinidae, fig. 4, 13–16. In the Galeo rhinidae it is better described as a fold instead of as a membrane. In all cases it is likely that onl with some aid by muscular retraction of the ball can it be made to entirely cover the eye. Plate 5 indicates some of the variations in the pupil of the eye. The oblique pupil of the Centraciontida (Port Jackson Sharks) is shown on Plate **45**, fig. 1.

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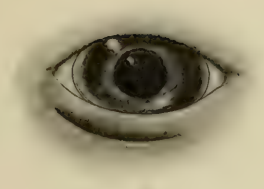

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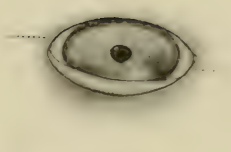

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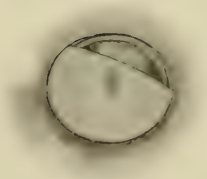

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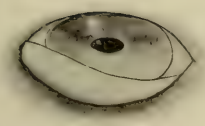

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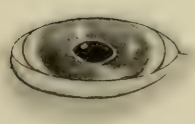

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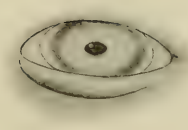

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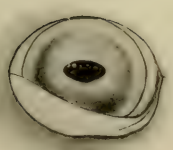

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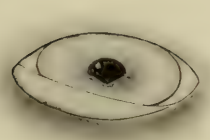

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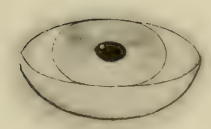

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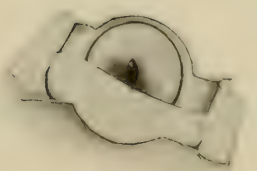

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16

E. N. FISCHER, LITH.

HELIOTYPE CO.

PLATE 51.

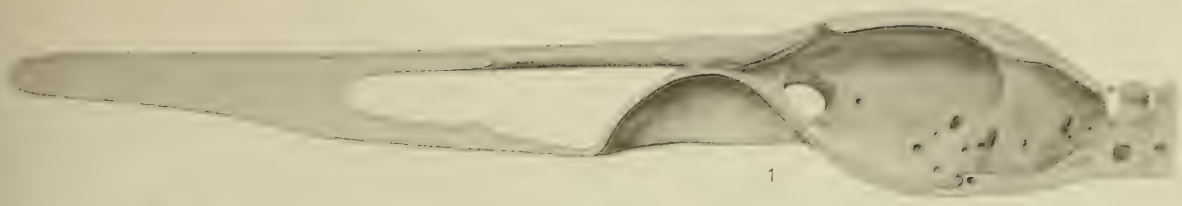
PLATE 51.

CARCHARIDAE.

Fig. 1–6. SCAPANORHYNCHUS OWSTONI. M. C. Z. 1048 (Page 28). Fig. 7. CARCHARIAS TAURUS. M. C. Z. 210 (Page 25).

1. Skull in longitudinal section.
2. Branchial skeleton from below.
3. Branchial skeleton from above.
4. Pelvis and radials.
5. Heart, conus, and arteries.
6. Intestine with spiral folds.
7. Intestine.

In most features the structure of Scapanorhynchus is closely allied to that of Carcharias. This is very evident in the parts of the anatomy given on this plate but not previously figured. At first sight the snout appears to present most divergence but most of this disappears on closer comparison of the long snout with the short one. The large cartilage in fig. 3 behind the copula, glossohyal, between it and the first ceratobranchial, is the first hypobranchial; it is present also in Carcharias, see Fürbringer, 1903, Morph. jahrb., **31**, pl. 17, f. 20 *x*. Three extrabranchials are shown in fig. 2 of Plate **51**, a slender rudiment of a fourth was present. As in most other items, the intestines of these genera, fig. 6, 7, have much in common.



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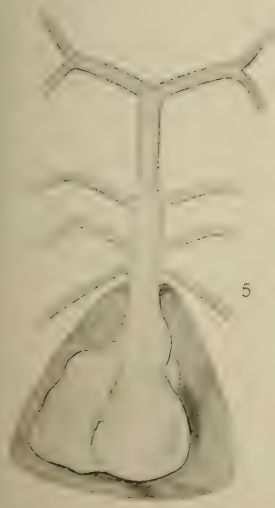

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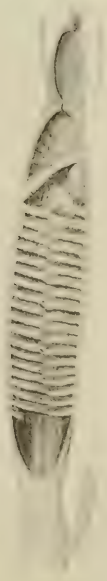

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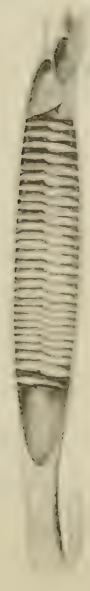

7

HELIOTYPE CO.

PLATE 52.

PLATE **52**.

Pelvis of ANTACEA and DIPNOI.

Fig. 1. Scoliodon longurio. M. C. Z. 694 (Page 114). Fig. 2. Hemigaleus pectoralis. M. C. Z. 847 (Page 150). Fig. 3. Pristiophorus japonicus. M. C. Z. 1045 (Page 246). Fig. 4. Protopterus annectens. M. C. Z. 8964. Fig. 5–7. Ceratodus forsteri. M. C. Z. 9827.

1–5. Lower view.
6. Upper view.
7. Lateral view.

The pelvis of the Antacea, fig. 1–3, is radically different from that of the Dipnoi, fig. 4–7. The differences are of such characters that no evidences of close relationships are evident. The structure in the sharks, the Antacea, is farther than that in certain of the more specialized of the Platosomia, the Potamotrygons, for instance, Plate **54**, fig. 1–2, from that in these Dipnoi; yet undoubtedly such resemblances as exist between the pelvis of the Lung Fishes and that of the River Trygons, in the median propelvic cartilage, is due to similarity of conditions and habits and not to inheritance from common ancestors. The pelvis of Polypterus is still more remote, nearer to that of bony fishes.

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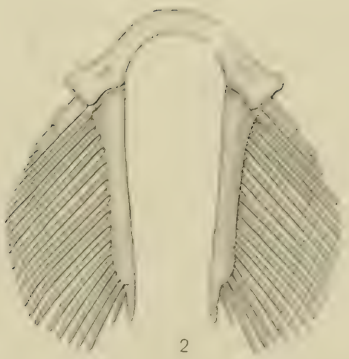

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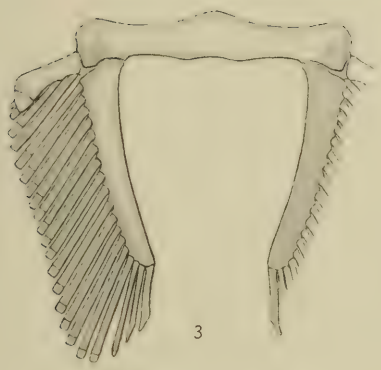

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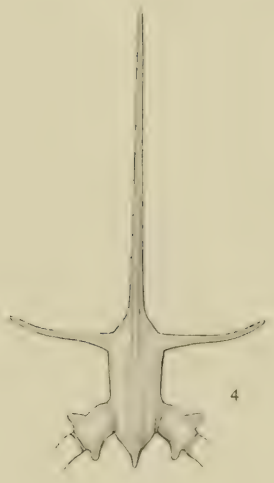

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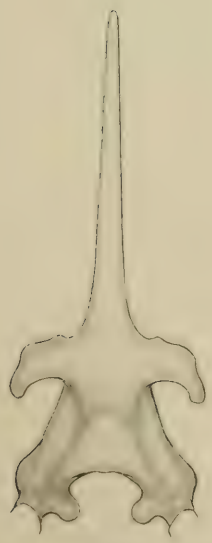

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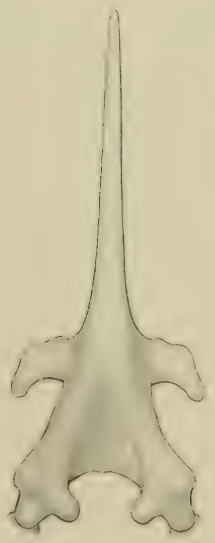

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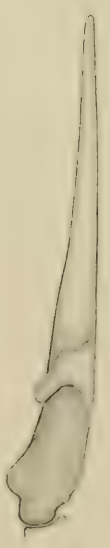

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E. N. F. Scher, del.

Heliotype Co.

PLATE 53.

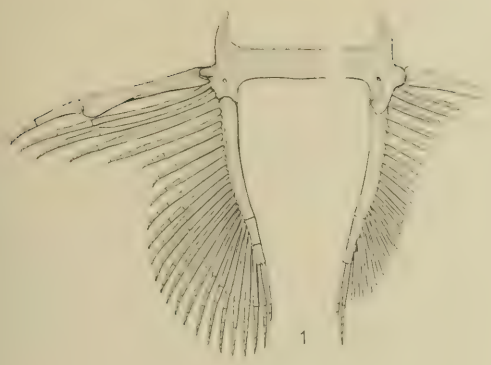
PLATE 53.

Pelvis of PLATOSOMIA.

Upper and lower surface.

Fig. 1. Uraptera agassizii. M. C. Z. 549 (Page 367).
Fig. 2. Narcacion californicus. M. C. Z. 43 (Page 311).
Fig. 3. Urobatis sloani. M. C. Z. 35 (Page 402).
Fig. 4. Taeniura lymma. M. C. Z. 23 (Page 399).
Fig. 5. Dasybatus marinus. M. C. Z. 641 (Page 382).
Fig. 6. Pteroplatea altavela. M. C. Z. 386 (Page 415).

The pelvis of the Raiidae, fig. 1, with the lateral prepelvic processes, recalls that of Cyclobatis, a fossil genus. The pelvis of Narcacion, fig. 2, is raioid, but is more arched backward in the middle. Figures 3–6 represent the Dasybatidae, in which family the organ is more like that of the Antacea, which have neither lateral nor median processes in front of the pelvis.



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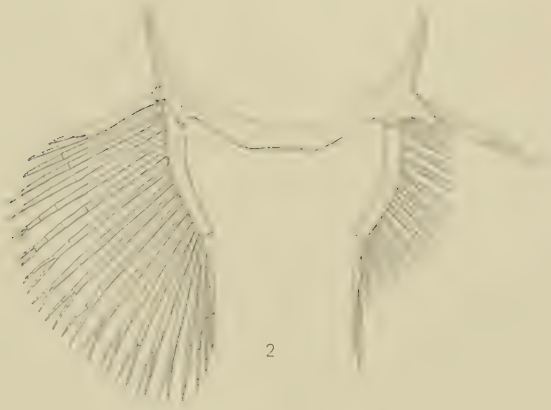

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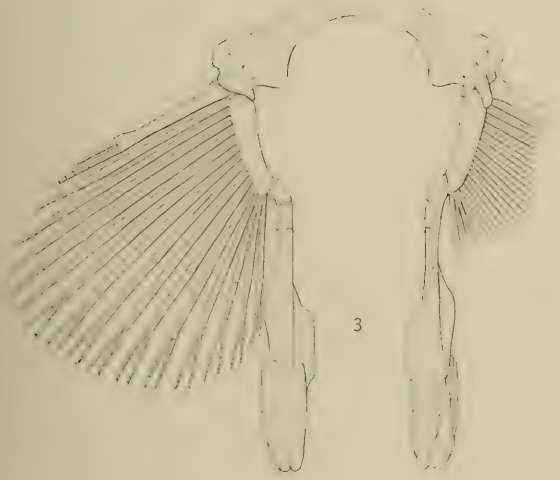

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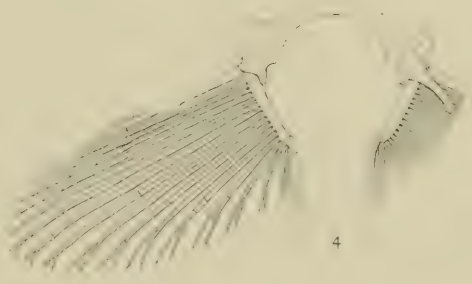

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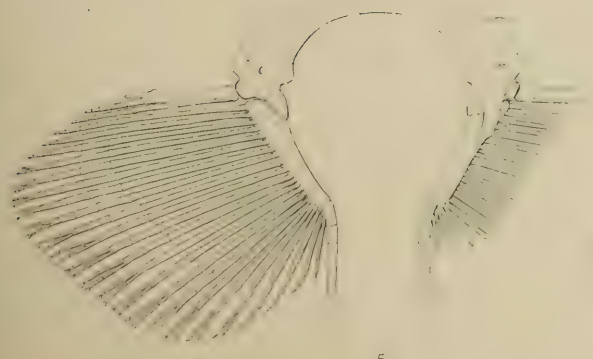

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6

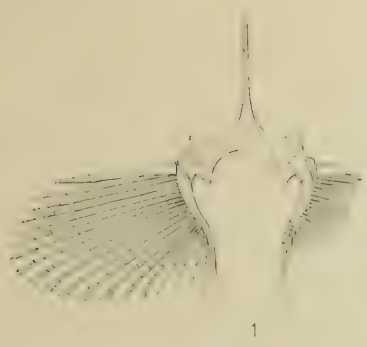
PLATE 54.

PLATE 54.

Pelvis of PLATOSOMIA.

Fig. 1. Potamotrygon circularis. M. C. Z. 296 (Page 419).
Fig. 2. Discеus thayeri. M. C. Z. 606 (Page 426).
Fig. 3. Myliobatis freminvillii. M. C. Z. 1160 (Page 432).
Fig. 4. Aëtobatus narinari. M. C. Z. 389 (Page 441).
Fig. 5. Rhinoptera jussieui. M. C. Z. 863 (Page 447).
Fig. 6. Mobula hypostoma. M. C. Z. 683 (Page 453).

The figures on this plate are from a group of the Platosomia characterized by a median process in front of the pelvis, among other features. The process is shortest in the Myliobatidae, fig. 3–4, longer in the Mobulidae, fig. 6 and longest in the Potamotrygonidae. Its presence has no bearing on a question of affinity with Dipnoi, Plate **52**, fig. 4–7.



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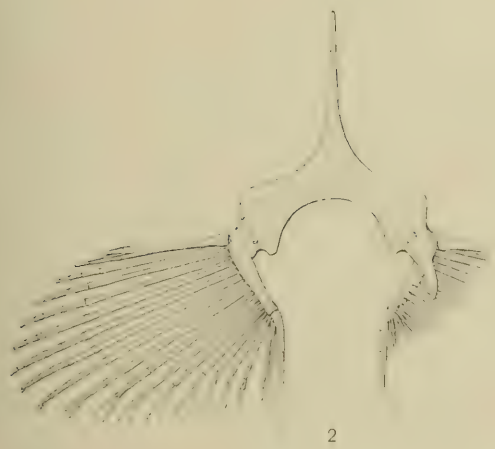

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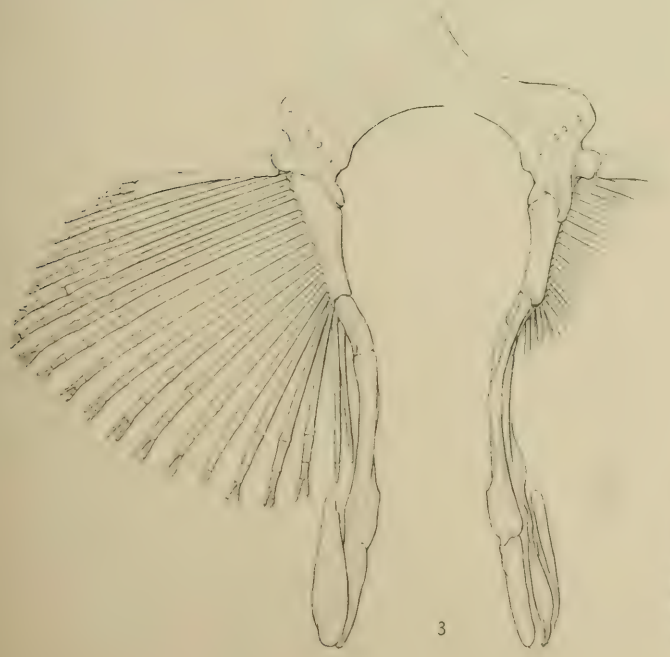

3

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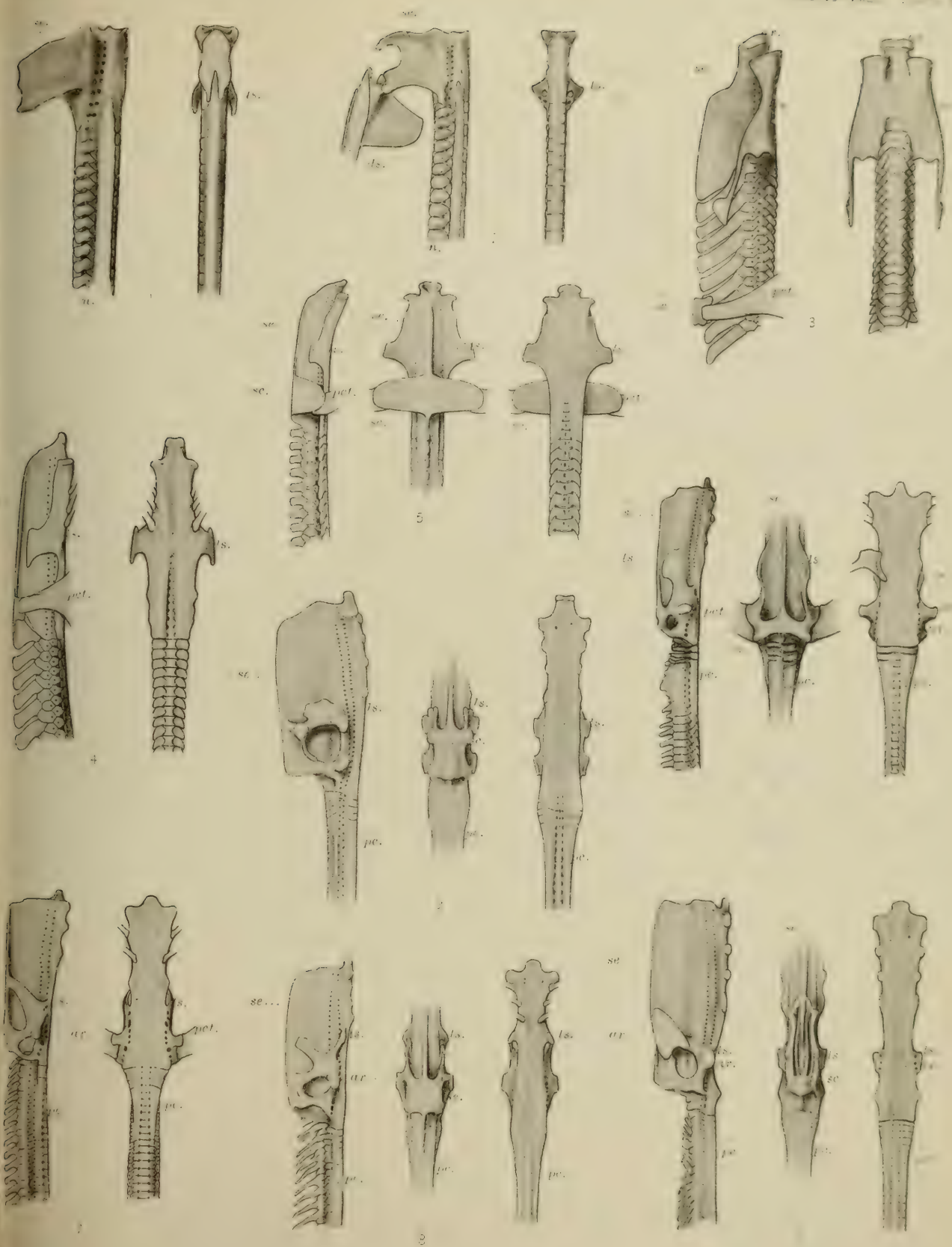
PLATE 55.

PLATE 55.

ANTERIOR VERTEBRAE.

Fig. 1. Callorhynchus tritoris. M. C. Z. 173. Fig. 2. Chimaera monstrosa. M. C. Z. 326. Fig. 3. Pristis microdon. M. C. Z. 302 (Page 265).* Fig. 4. Rhinobatus percellens. M. C. Z. 430 (Page 278). Fig. 5. Raia erinacea. M. C. Z. 358 (Page 337). Fig. 6. Potamotrygon laticeps. M. C. Z. 290 (Page 417). Fig. 7. Taeniura lymma. M. C. Z. 620 (Page 399). Fig. 8. Myliobatis californicus. M. C. Z. 636 (Page 429). Fig. 9. Aëtobatus narinari. M. C. Z. 677 (Page 441). Fig. 10. Rhinoptera jussieui. M. C. Z. 863 (Page 447).

Figures 1 and 2 show the condition of the vertebrae in the Chismopnea, how few of them are included in the consolidation, the articulation of the erectile spine, and the condition of the notochord, without rings in Callorhynchus, fig. 1, with rings in Chimaera, fig. 2. Figures 3–10 are from among the lowest to the highest of the Platosomia. They indicate the gradually increasing number of the vertebrae taking part in the anchylosis, with the decrease in size and withdrawal backward of the lateral wings or stays so prominent in the Pristidae, fig. 3, the scapulary attachment of the shoulder girdle superior in Pristidae and Rhinobatidae, fig. 3–4, inferior in the Raiae, fig. 5, and a lateral articulation in Dasybatidae, fig. 7, Potamotrygonidae, fig. 6, Myliobatidae, fig. 8, Rhinopteridae, fig. 10 and the Mobulidae. The different styles of attachment of the shoulder girdle apparently divide the Platosomia into groups. A considerable increase in irregularity of vertebrae and processes obtains as the most specialized genera are approached.



COCKAYNE, BOSTON

PLATE 56.

PLATE 56.

HEART.

Fig. 1. Heptranchias perlo. M. C. Z. 945 (Page 21). Fig. 2. Scaphanorhynchus owstoni. M. C. Z. 1048 (Page 28). Fig. 3. Orectolobus japonicus. M. C. Z. 1038 (Page 50). Fig. 4. Cephaloscyllium umbratile. M. C. Z. 1044 (Page 80). Fig. 5. Isurus punctatus. M. C. Z. 1249 (Page 36). Fig. 6. Pristiophorus japonicus. M. C. Z. 1045 (Page 246). Fig. 7. Rhinobatus percellens. M. C. Z. 430 (Page 278). Fig. 8. Discobatus sinensis. M. C. Z. 1120 (Page 289). Fig. 9. Narcacion marmoratus. M. C. Z. 42 (Page 305). Fig. 10. Narke japonica. M. C. Z. 1114 (Page 314).

Rather generally the number of rows of valves in the conus of the Antacea decreases with advance in rank, with increase in specialization. For proof of this compare Heptranchias, fig. 1, Scaphanorhynchus, fig. 2, Isurus, fig. 5, and Pristiophorus, fig. 6, with Orectolobus, fig. 3, and Cephaloscyllium, fig. 4. In the Platosomia the rule does not hold so well, as is shown by comparing Rhinobatus, fig. 7, of this Plate with greatly specialized types, Plate **57**, fig. 1–6.

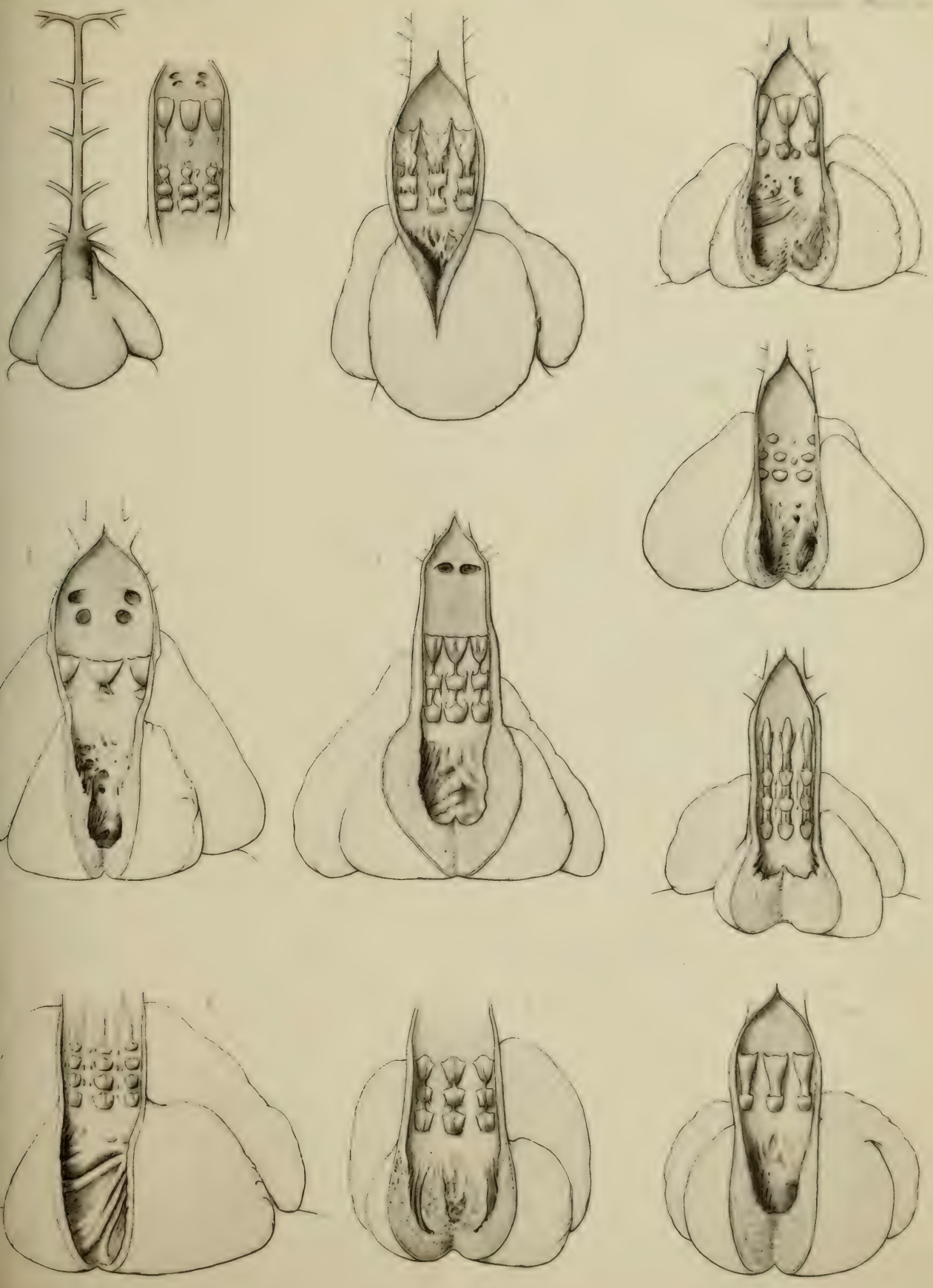


PLATE 57.

PLATE 57.

HEART.

Fig. 1. Sympterygia acuta. M. C. Z. 632 (Page 370). Fig. 2. Disceus thayeri. M. C. Z. 297 (Page 426). Fig. 3. Pteroplatea altavela. M. C. Z. 336 (Page 415). Fig. 4. Aëtobatus narinari. M. C. Z. 677 (Page 441). Fig. 5. Rhinoptera jussieui. M. C. Z. 863 (Page 447). Fig. 6. Mobula hypostoma. M. C. Z. 683 (Page 453). Fig. 7–10. Ceratodus forsteri. M. C. Z. 9827.

The majority of the more differentiated of the families of the Platosomia have a larger number of rows of valves in the conus than others commonly accepted as much lower in rank; that is, with increase in specialization decrease in the number of valves does not obtain as regularly as in the Antacea. This is substantiated by contrast of Rhinobatus, Plate **56**, fig. 6, with Aëtobatus, fig. 4, Rhinoptera, fig. 5, and Mobula, fig. 6, of Plate **57**.

Figures 7–10 represent the heart of Ceratodus.

For fig. 7 the pericardium was slit longitudinally and turned to the sides; for fig. 8 both conus and ventricle were opened, showing the upper end of the so-called spiral valve in the passage from the ventricle into the conus, the lower end of the passage with the end of the hinder one of a series of large thick-walled valves of the aditus, and the chamber of the ventricle with the basal, posterior, fibrous pad. The conus is thrown open in fig. 9 disclosing the transverse series of large valves immediately behind the arteries, and behind that series another transverse series of smaller valves; this figure also shows the somewhat spiral course of the opening from the ventricle, in dotted lines, with the end of a large valve at its origin, and the fibrous pad at the side of which is a large opening controlled by muscles into the ventricle. The inner two of the dotted lines roughly indicate the position of a longitudinal series of large valves laid bare in fig. 10 which shows one of the transverse series of large valves in front cut open to prove that this series originated from one of the hinder of several transverse series, the smaller valves of the anterior series being included by the larger valves; this figure also shows a longitudinal series in the aditus of large valves one of which was formed from each of the transverse series of small valves, at its left in the figure.

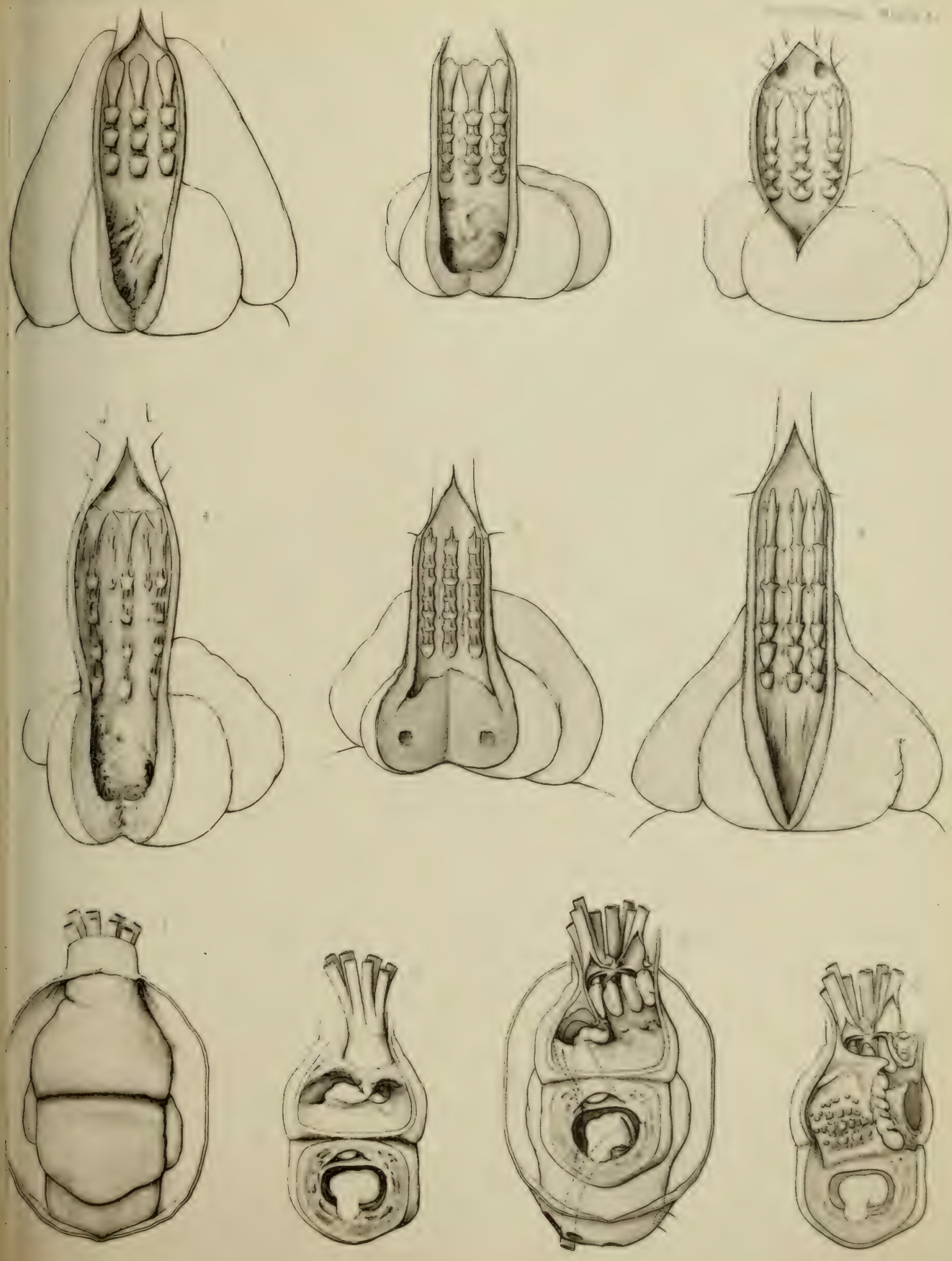


PLATE 58.

PLATE 58.

Intestines of ANTACEA and CERATODUS.

Fig. 1. Heptranchias perlo. M. C. Z. 945 (Page 21). Fig. 2. Cephaloscyllium umbratile M. C. Z. 1044 (Page 80). Fig. 3. Isurus punctatus. M. C. Z. 1249 (Page 36). Fig. 4. Hemigaleus pectoralis. M. C. Z. 847 (Page 150). Fig. 5. Pristiophorus japonicus. M. C. Z. 1045 (Page 246). Fig. 6. Ceratodus fosteri. M. C. Z. 9827.

There are marked differences between the intestine of the Plagiostomia and that of Ceratodus. The stomach of the former is distinctly separated from the spiral intestine, while that of the latter is a continuation forward of the spiral itself. The stomach and intestine of Ceratodus, fig. 6, form a continuous spiral the characters of the inner surfaces of which change from the villous of the stomach proper to the absobent of the intestine in a single turn of the winding course. The number of turns in Ceratodus is nine or ten; the axis of the spiral is firm and muscular. The number of turns in the intestinal spiral of the Plagiostomia varies in those dissected here from four in Hemigaleus, fig. 4, to thirty-nine in Isurus fig. 3.

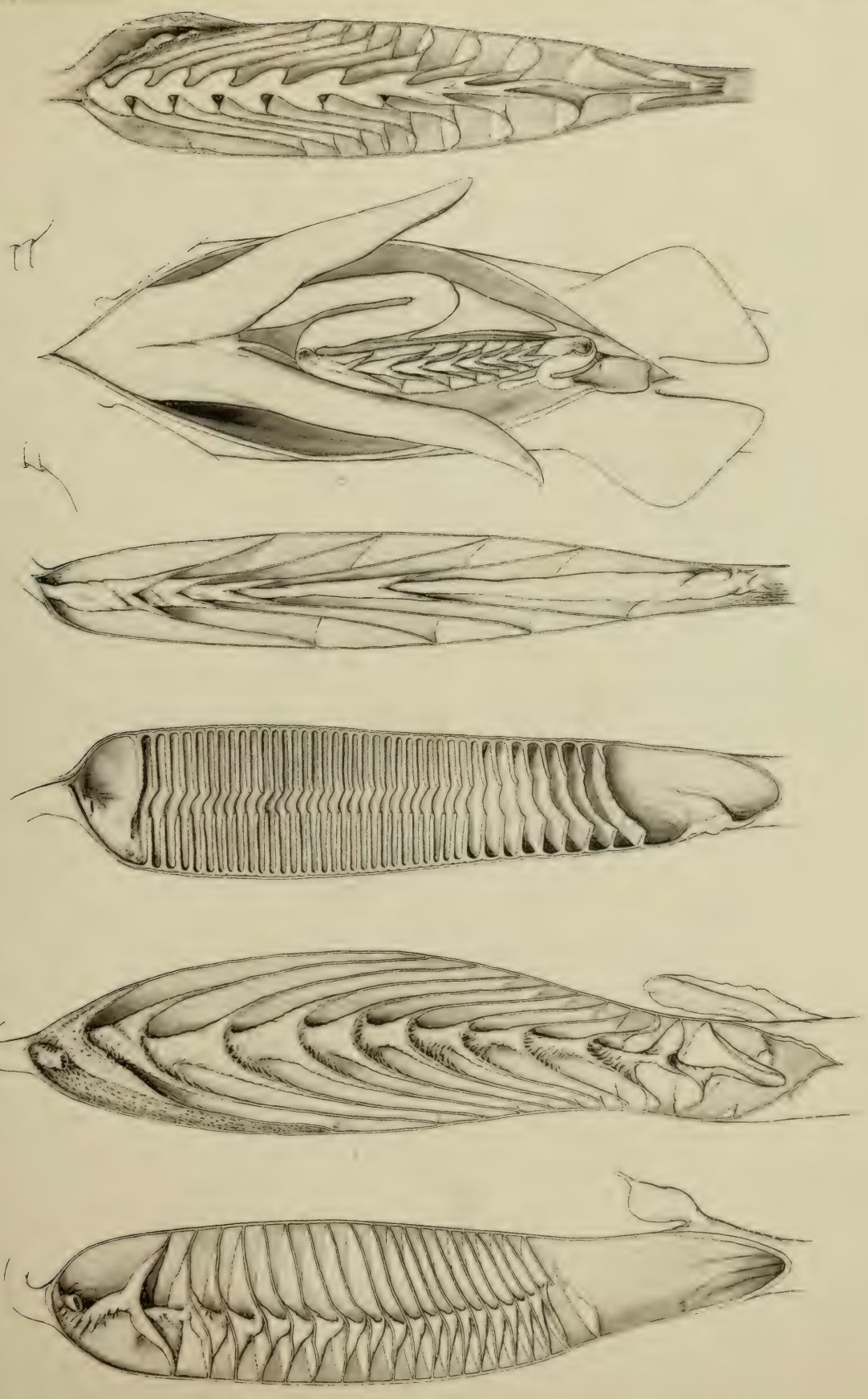


PLATE 59.

PLATE 59.

Fig. 1–2. Squalus acanthias. M. C. Z. 35 (Page 192). Fig. 3. Ginglymostoma cirr. M. C. Z. 819 (Page 54). Fig. 4–6. Chlamydoselachus anguineus. M. C. Z. 1247, 1285 (Pag Fig. 7–8. Mobula hypostoma. M. C. Z. 683 (Page 453). Fig. 9–10. Rhinoptera jus. M. C. Z. 863 (Page 447).

Figure 1, $\frac{4}{7}$ natural size, and fig. 2, natural size, exhibit the outer and the internal yolk-sa heart with arteries, the liver, the stomach, and the intestine. Figure 3, $\frac{7}{12}$ natural length, is the Ginglymostoma, the embryo showing through the shell. Figure 4–5, $\frac{5}{7}$ nat., show the egg wi embryo of Chlamydoselachus. Fig. 7–8 show the appearance of the gill plates of Mobula, a 9–10 those of Rhinoptera. There is in the latter a longitudinal division of the plates into upp lower parts, in fig. 9 there are also seen modifications to some extent intermediate in character be the plates in fig. 10 and those of Mobula.

Figure 6, of Chlamydoselachus, was made for comparison with the type and with figures in recent articles by Fürbringer and Goodey. In a number of points it is at variance with the figure tioned and agrees more nearly with the type. There is no point behind the middle of the first ba as in Fürbringer, 1903, Morph. jahrb. **31**, pl. 27, f. 18 or in Goodey, 1910, Proc. Zool. soc. Lond., f. 6 "bbr. 1 (?)." The basibranchials are more numerous and regular than in either of the men figures. The hypobranchials are present in five pairs, the hindmost pair being displaced and below the junction of the sixth ceratobranchial and the basibranchial; these cartilages are those as the vestigial seventh arch, Goodey, *loc. cit.*, pl. 43, fig. 6, "b a 7 (?)." The seventh arch w covered and figured by Fürbringer, 1903, as an "eventuel Rudiment einer siebenten Kiemenbo it is of much greater development in this Plate than in either of the other figures.

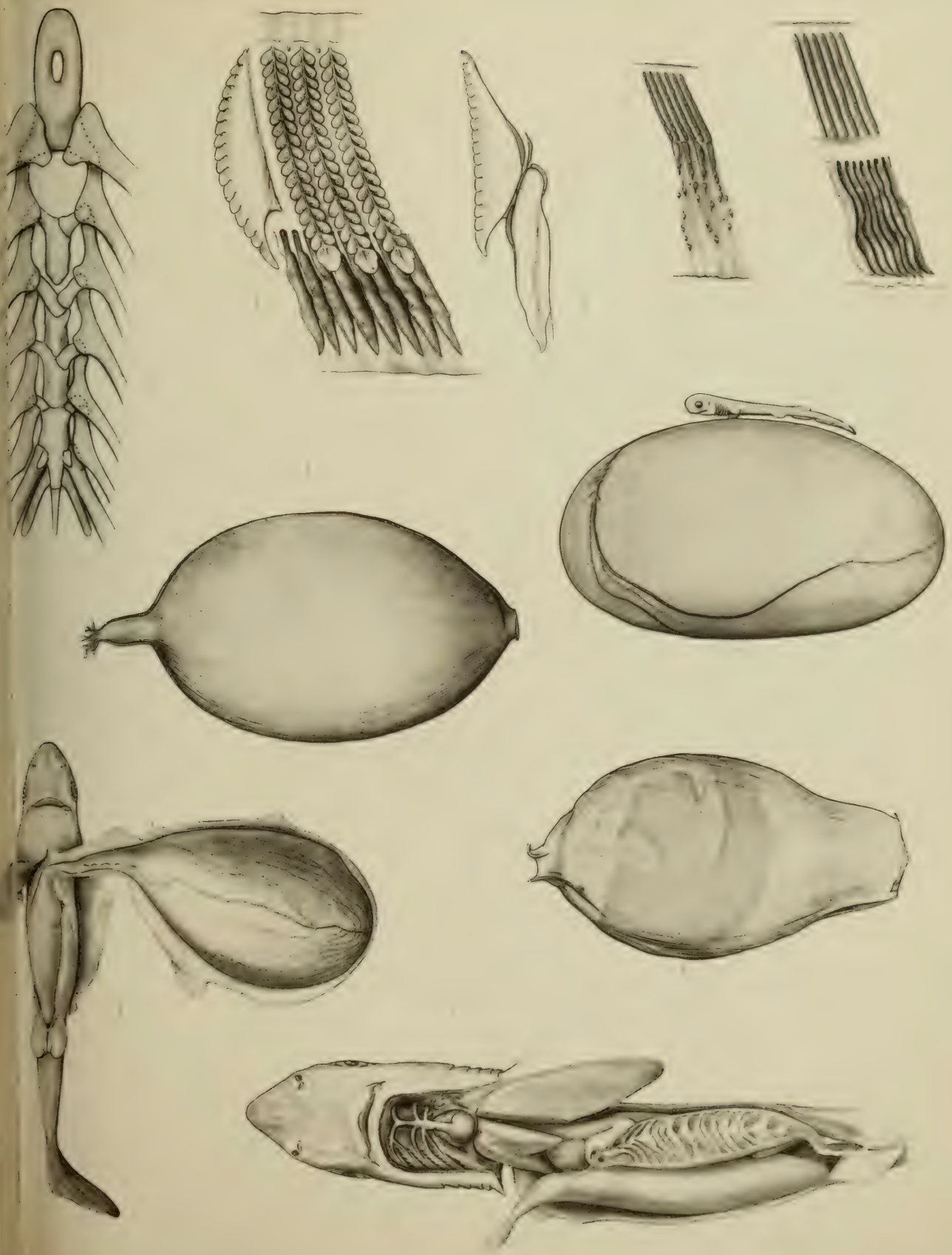


PLATE 60.

PLATE 60.

ANTACEA.

Fig. 1–4. Galeorhinus laevis (Page 176). Fig. 5–9. Squalus acanthias (Page 192).

1. Nearly natural length. M. C. Z. 1301.
2–3. Nearly natural length. M. C. Z. 1304.
4. Nearly natural length. M. C. Z. 1303.
5. Two thirds natural length.
6. Twice natural length.
7–9. Natural size.
5–9. M. C. Z. 1305.

Figure 1 represents the egg in its membranous envelope before the appearance of the embr
Figures 2–4 show the embryo with the egg near the time the latter attaches itself to the wall of
oviduct, the attachment being a consequence of active development of the blood vessels and ra
depletion of the nutriment of the egg. Partially attached eggs, before entire disappearance, are c
siderably modified on the side in contact with the wall to which after the egg is absorbed the emb
remains attached by the cord. The egg of Squalus, fig. 5 and 7, is one that carries a sufficient amo
of nutriment for the development and growth of the embryo without attachment to the surround
walls. The distribution of the blood vessels over the yolk differs much from that in fig. 2–4.

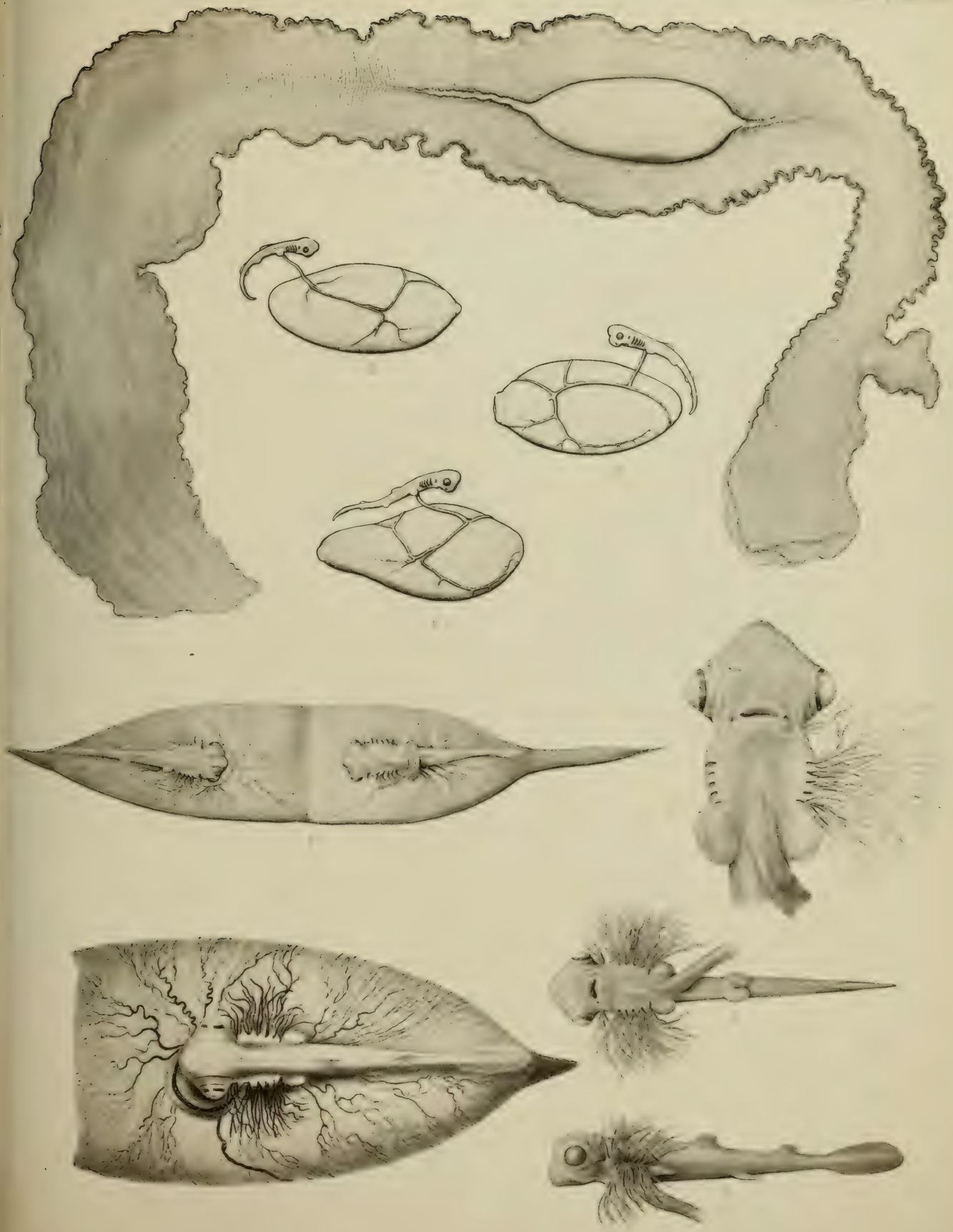


PLATE 61.

PLATE 61.

PLATOSOMIA and ANTACEA.

Fig. 1–3. Narcacion marmoratus (Page 305). Fig. 4–5. Narcacion nobilianus (Page 310). Fig. 6. Narcine timlei (Page 300). Fig. 7–8. Chlamydoselachus anguineus (Page 14). Fig. 9–11. Rhina californica (Page 253).

1–3. Various stages from De Sanctis, 1872.
4–5. Four fifths and natural length. M. C. Z. 1016.
6. One and two thirds natural length.
7–8. One and three fourths natural length. M. C. Z. 1285.
9–10. Five sixths natural length. M. C. Z. 916.
11. Two and two thirds natural length. M. C. Z. 916.

The first three figures illustrate the squaliform raiiform and torpediform stages socalled by De Sanctis (1872, Atti Reale accad., **5**, pl. 1, fig. 3, 6, 9.) In fig. 3 the forward extension of the pectorals, the sides of the batteries, is strongly marked while the lateral growth of the antorbital process ultimately forming the front of the disk has hardly begun; at this stage the latter merely forms a pad in front of the head. Figures 4 and 5 from a specimen off the coast of New England illustrate the lateral growth of the antorbital portions of the disk to meet the forward extensions of the pectorals and, with the obliteration of the notch opposite each eye, complete the disk. See the skeleton of *N. marmoratus* on Plate 6 *ao*. The batteries are well developed and the disk completely outlined at a very small stage of *Narc. timlei*, fig. 6. In connection with fig. 7–8, showing the young Chlamydoselachus with well differentiated fins and external gills, see also fig. 4–5, Plate **59**. The embryo of *Rhina californica*, fig. 9, was attached to an enormous mass of yolk, longer and many times the weight of the little shark. Figures 10 and 11 show the intestines and their connection with this yolk, the dotted lines indicating the entrance in front of the spiral folds.

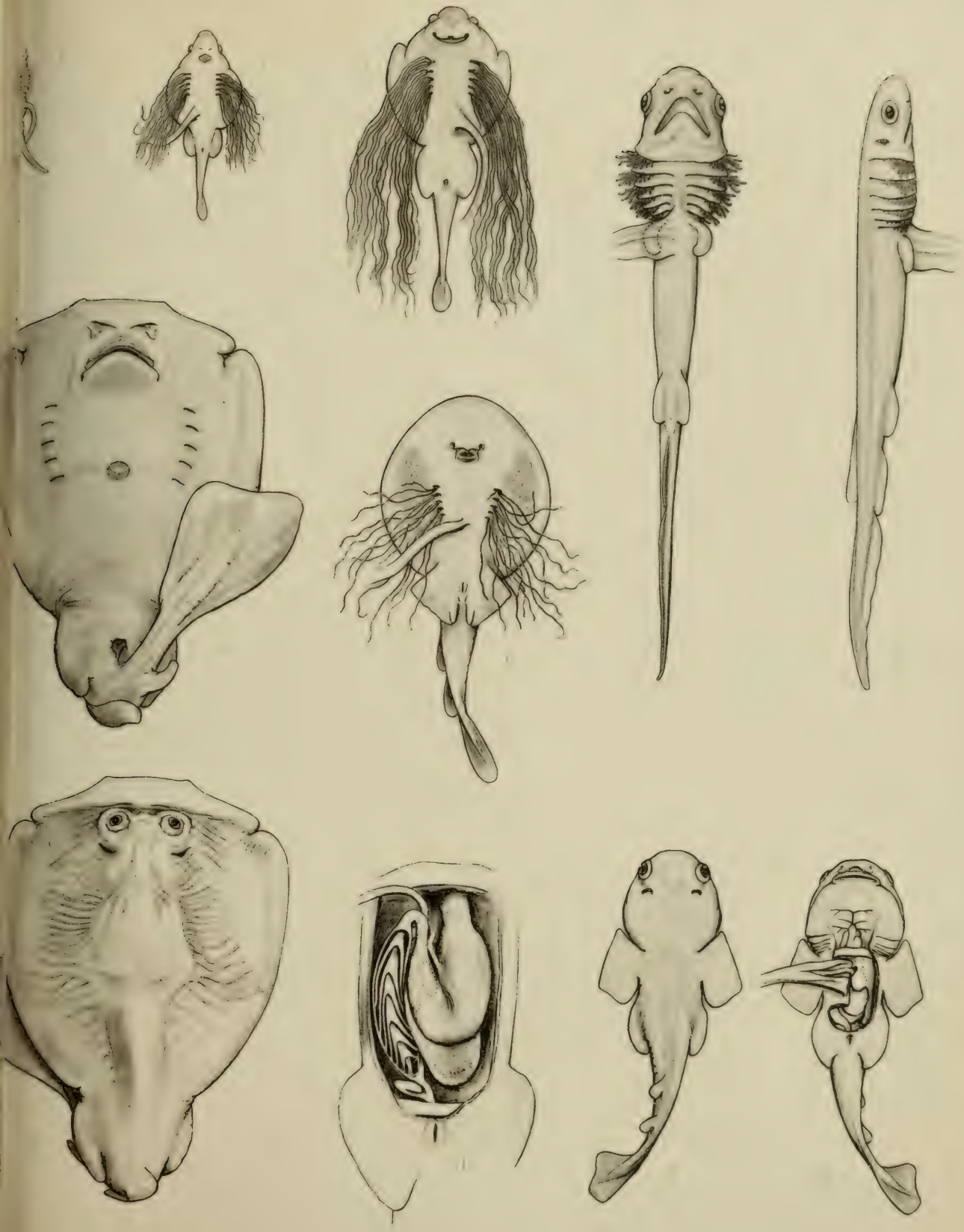


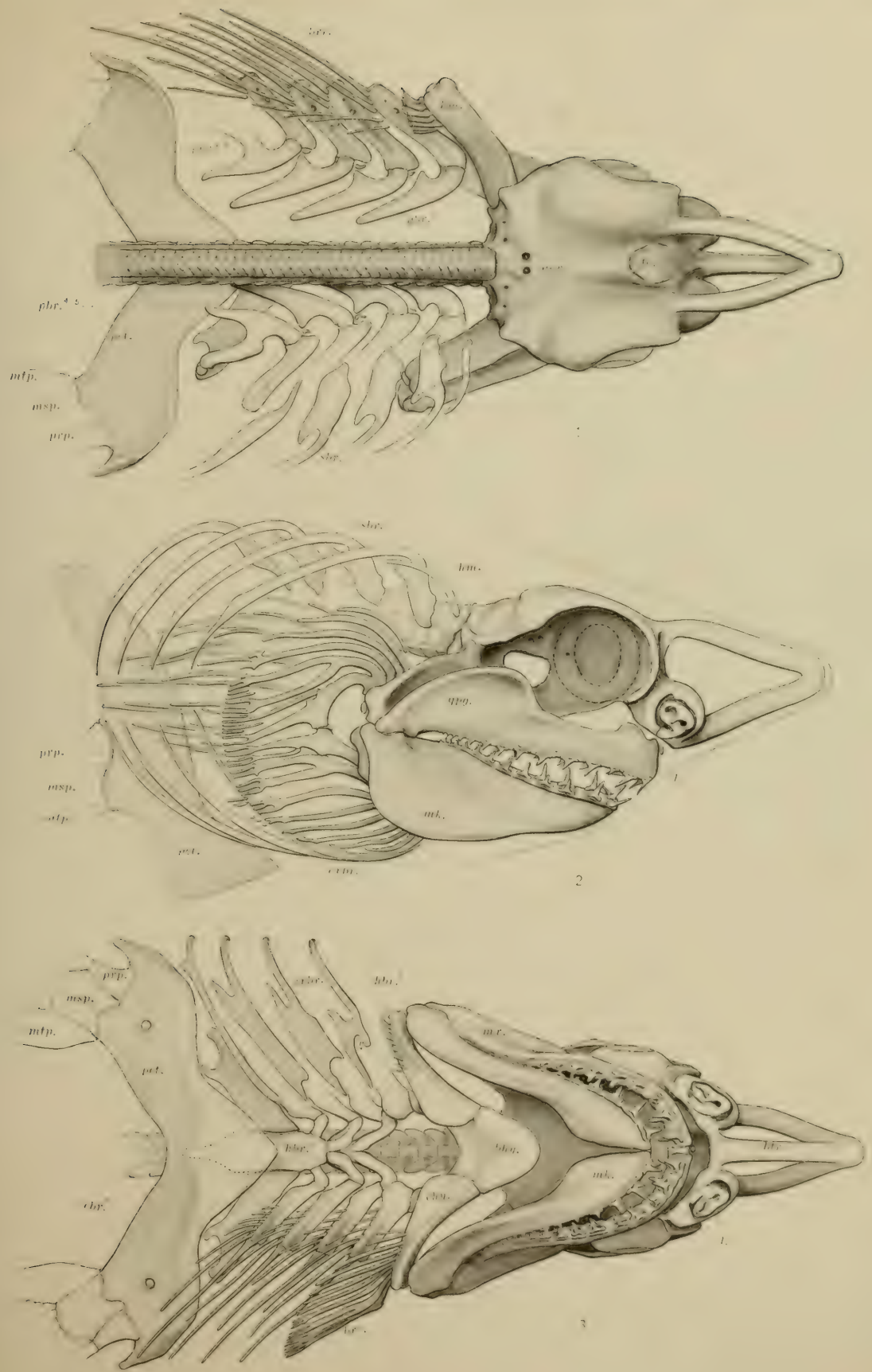
PLATE 62.

PLATE 62.

ISURIDAE.

Fig. 1–3. Isurus punctatus (Page 36).

1. Dorsal view of the skull, vertebrae, branchial cartilages, and shoulder girdle.
2. Lateral view of the skull, jaws, teeth, branchial cartilages, and shoulder girdle.
3. Ventral view of the skull, jaws, teeth, branchial cartilages, vertebrae, and shoulder girdle.



HELIOTYPE CO.

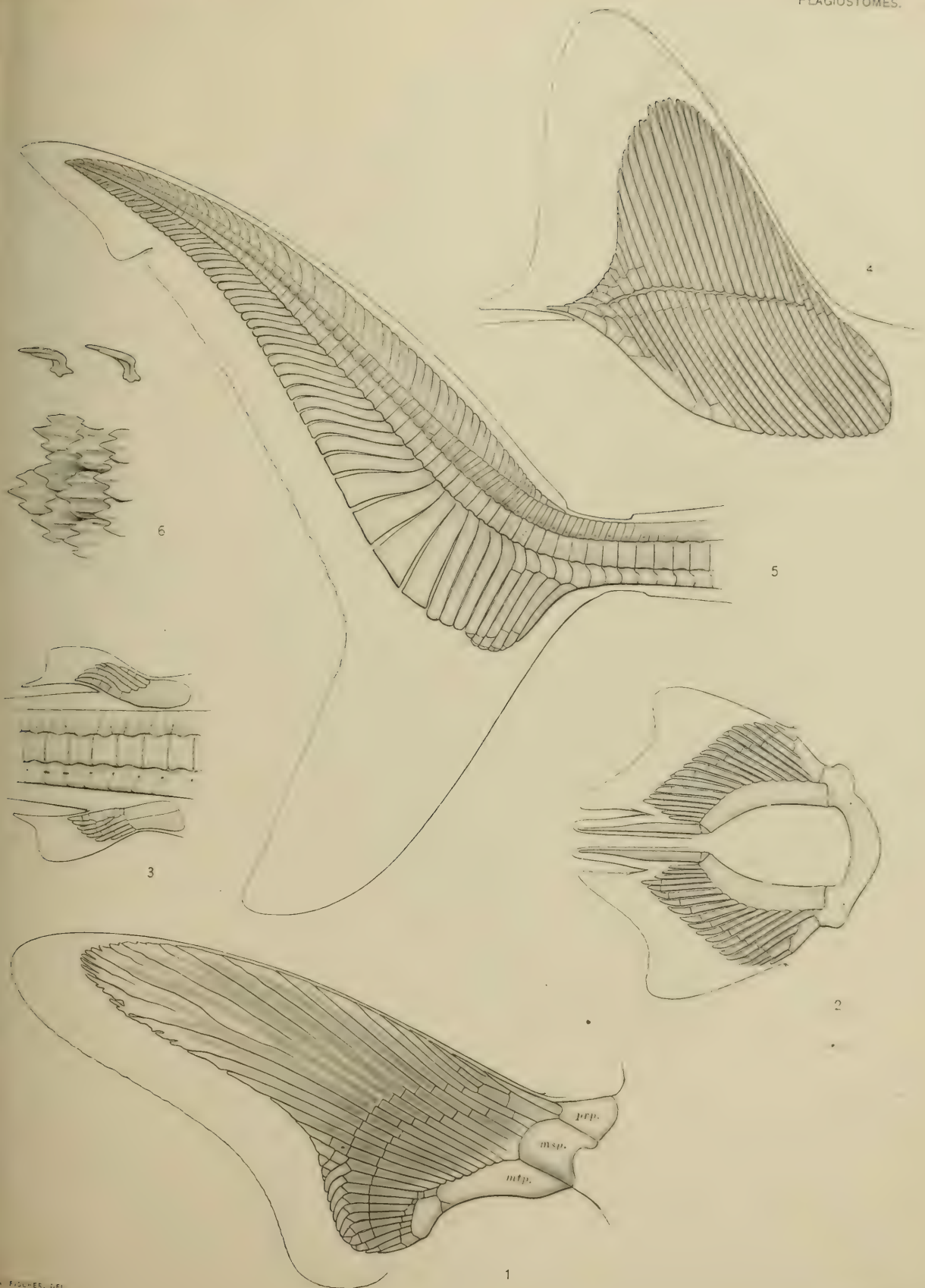
PLATE 63.

PLATE 63.

ISURIDAE.

Fig. 1–6. Isurus punctatus (Page 36).

1. Pectoral fin.
2. Pelvis and ventral or pelvic fins.
3. Vertebral column, second dorsal fin, and the anal fin.
4. First dorsal fin.
5. Caudal fins and vertebrae.
6. Scales from near the middle of the flank.



E. A. Fischer, del.

Electype Co.

PLATE 64.

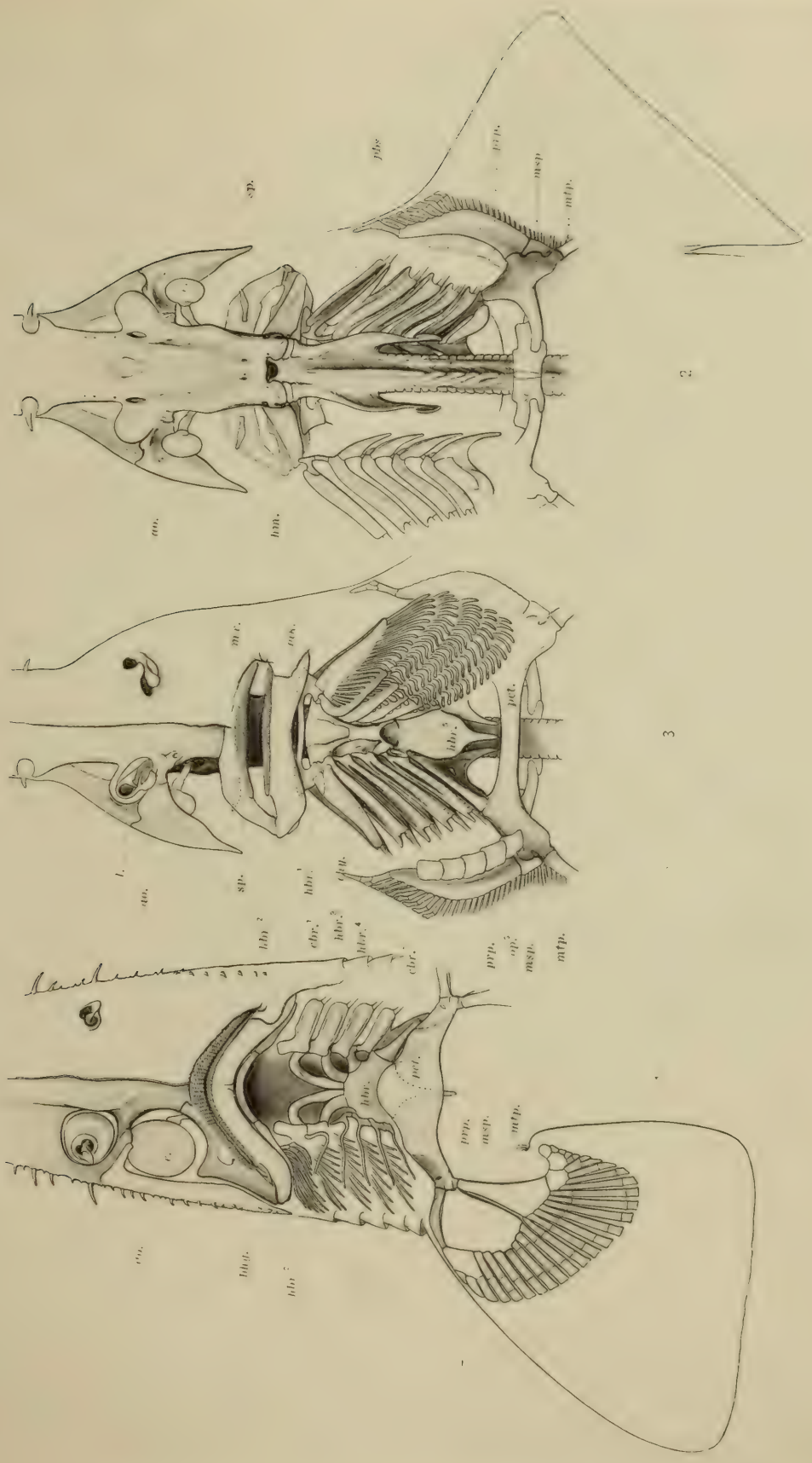
PLATE 64.

PRISTIOPHORIDAE and PRISTIDAE.

Fig. 1. Pristiophorus japonicus (Page 246). Fig. 2–3. Pristis microdon (Page 265).

1. Dorsal view. M. C. Z. 1045.
2. Dorsal view. M. C. Z. 302.
3. Ventral view. M. C. Z. 302.

A species of the Antacea is placed by the side of one of the Platosomia to give prominence to differences between the two groups, which appear especially, among others, in the jaws, the branchial skeleton, the shoulder girdle and the pectoral fins. The girdle of the shark, fig. 1, is remotely attached to the vertebrae in its scapulary extensions; it is considerably arched and the fins are placed rather behind its transverse axis. In the ray, fig. 2, the girdle is firmly and superiorly attached to the vertebrae by means of a scapular element and the fins are lateral and forward of the articulations as well as behind them. The copula, *bhy*, is divided into sections, segmented, and distinct from the cartilages behind it; in the ray it is unsegmented and is attached to the ceratohyals, *chy* (*ehy* in Plate). Strong cartilages appear in the gill covers of the ray, *sp*. The postbranchial stay, *pbs*, has its greatest development in Pristis and, as shown in the following plates, dwindles in approaching the rays of highest rank.


2
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1
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psp.
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sp.
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ebr.
ppp.
msp.
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pct.
hbr.
ppp.
msp.
mtp.
an.
hbr.1
hbr.2

PLATE 65.

PLATE 65.

RHINOBATIDAE.

Fig. 1. Rhynchobatus djiddensis. M. C. Z. 806 (Page 268). Fig. 2. Rhinobatus percellens. M. C. Z. 435 (Page 278). Fig. 3. Syrrhina brevirostris (Page 285).

The skeleton of the Rhinobatidae is closely allied to that of the Pristidae. The copula, *hbr* 1, is unsegmented, the other basibranchials are broadened fused and contorted, the antorbital, *ao*, is extended farther outward from the skull and the shoulder girdle is much widened. The basibranchials are sketched from young individuals and must of course differ considerably from those of larger or adult specimens.

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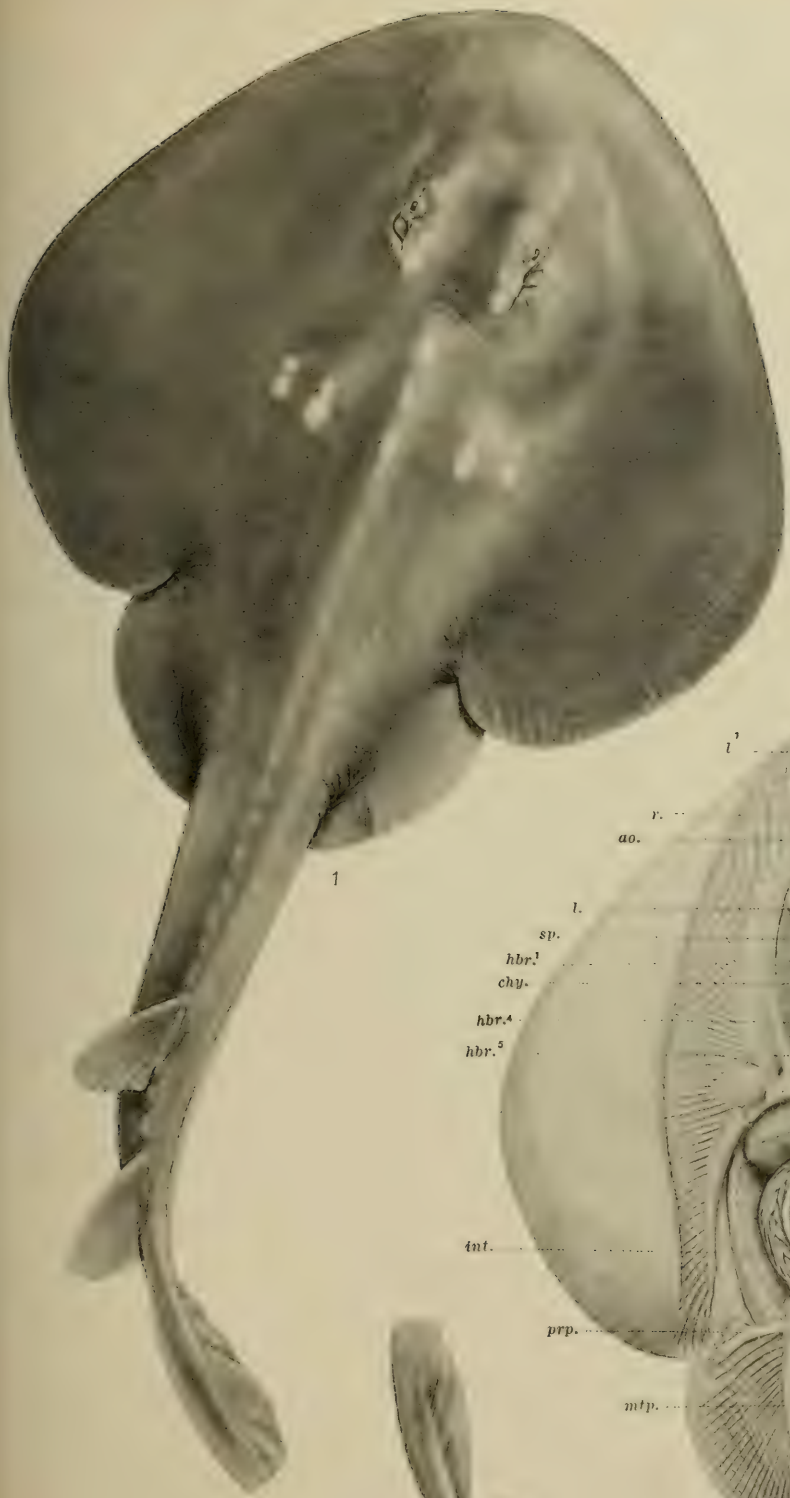
PLATE 66.

PLATE 66.

DISCOBATIDAE.

Fig. 1–3. Discobatus sinensis (Page 289).

The figures are taken from a female twenty-five and one fourth inches in length. The lower surface, fig. 2, has been dissected out so as to show the skeleton and the viscera. The mouth, fig. 3, was drawn as it appeared before dissection. Attention is directed to several features in which Discobatus to some extent approaches the Narcaciontidae. The rostral cartilage, *r*, ends abruptly a short distance in front of the skull and is supplemented by soft flexible branched extensions somewhat like those of Narcine. The antorbital, *ao*, has greatly extended forward and outward. The branchial rays are expanded at their outer extremities. There is a triangular group of ampullae, an incipient battery, opposite the end of each lower jaw. The copula, *h br'*, is unsegmented. The pelvis is very wide; it is provided with a slight anterior process at each end. The propterygium of the ventrals is considerably branched at its distal end. With the exception of the liver, which is indicated by dotted lines, the viscera are shown in position.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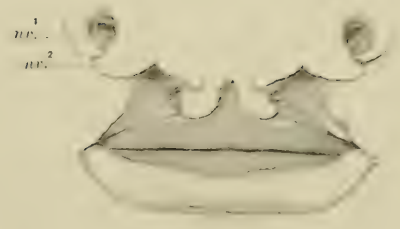
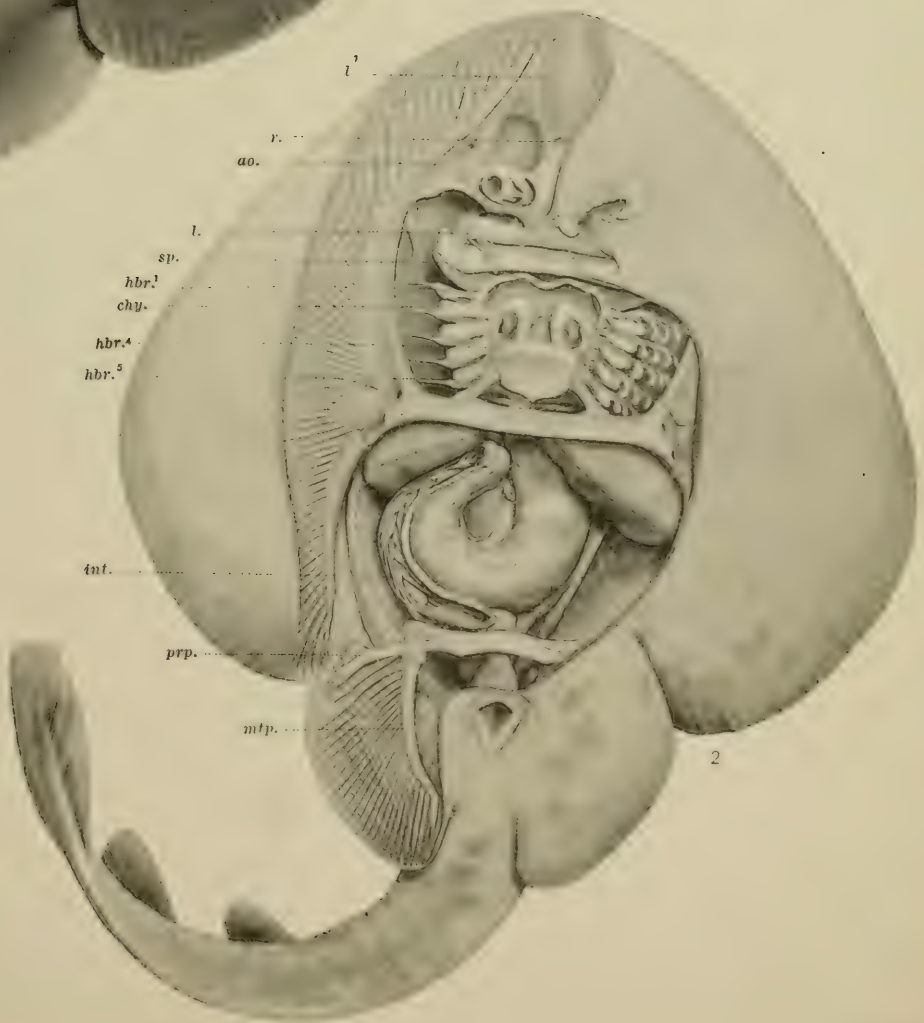

nv.1
nv.2
3


l.1
v.
ao.
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hbr.3
chy.
hbr.4
hbr.5
int.
prp.
mtp.
2

PLATE 67.

PLATE 67.

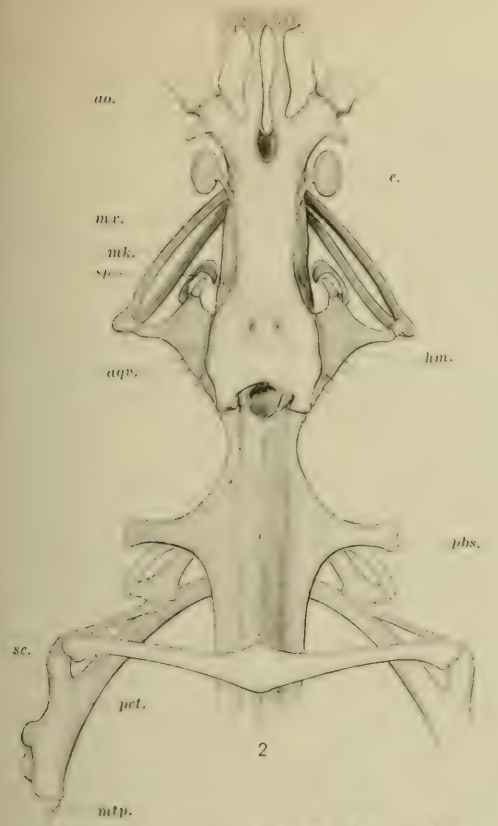
NARCACIONTIDAE.

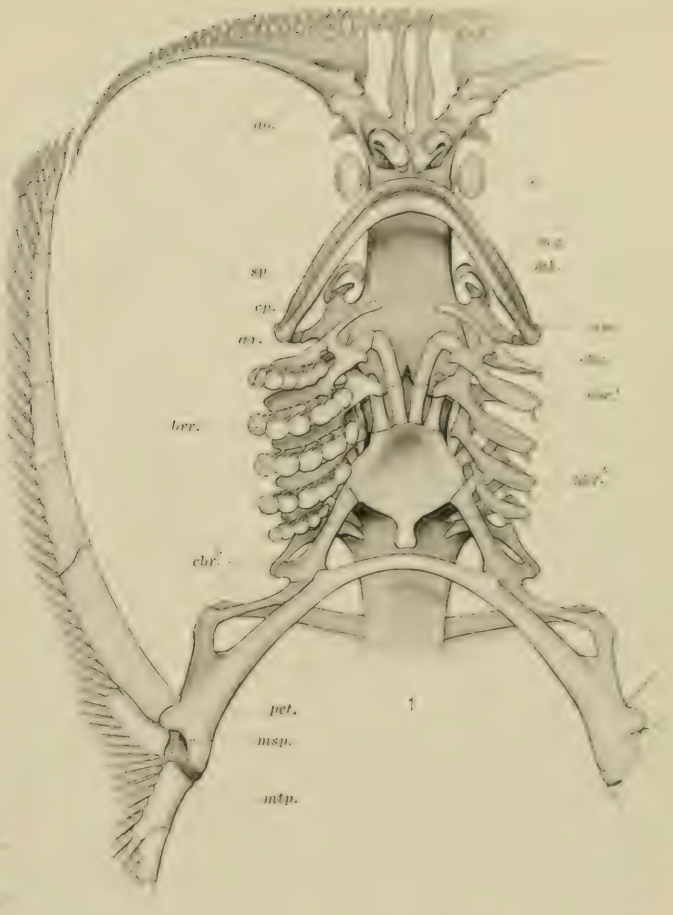
Shoulder girdle to snout.

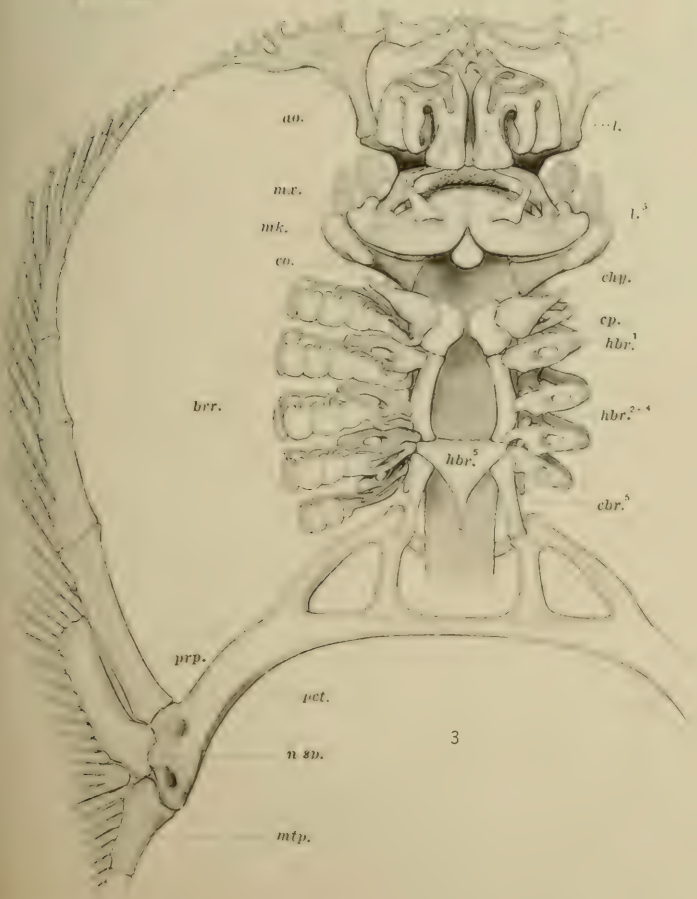
Fig. 1–2. NARCACION MARMORATUS. M. C. Z. 42 (Page 305). Fig. 3–4. NARKE JAPONICA. M. C. Z. 1114 (Page 314).

1, 3. Ventral view.
2, 4. Dorsal view.

The Torpedoes form the most distinct group of the Platosomia. Aside from the electric apparatus their skeletons would serve to place the family at a distance from the other families. The shoulder girdle, the antorbital and its function in the forward part of the disk, the peculiar rostral cartilages, the spiracular cartilages and their supplementals, and the slender branchial rays with their rounded plate-like extremities are very different from the same parts in the framework of the nearest allies. The incomplete copula, *co*, *cp*, and the arrangement of the joints of the propterygial basalia of the pectoral fins also illustrate this; and at the same time the genera of the Narcaciontidae differ widely from one another: — compare the elongate skull, long rostral cartilages, the anteriorly much dissected antorbitals, the wide postbranchial stays, *pbs*, the arrangement of the propterygial joints of the pectoral basalia, and the regularly articulated branchihyals of *Narcacion marmoratus* with the short skull, short rostral cartilage, the slightly dissected antorbitals, the narrow extent of the postbranchial stays, the labial cartilages, and the consolidated branchihyals of *Narke japonica*.







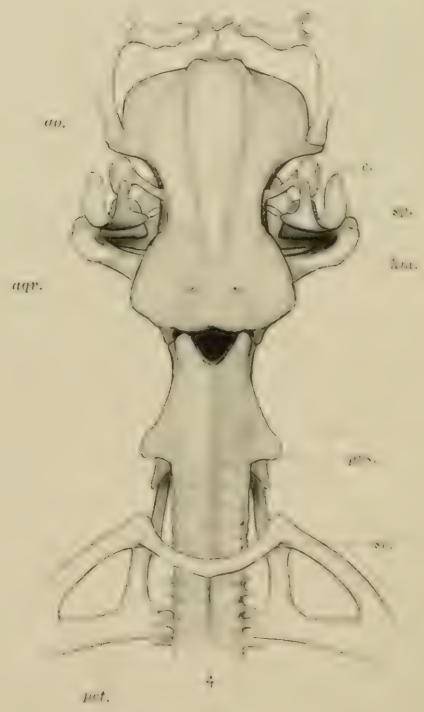


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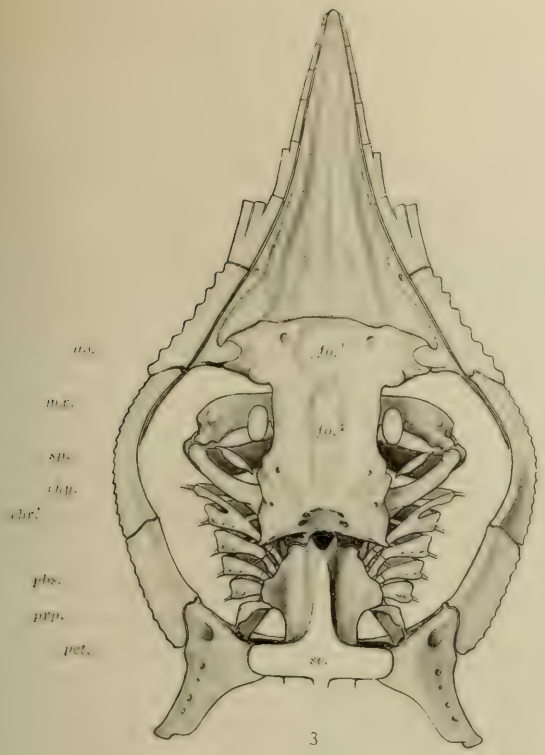
PLATE 68.

PLATE 68.

RAIIDAE.

Fig. 1. Raia erinacea. M. C. Z. 358 (Page 337). Fig. 2. Uraptera agassizii. M. C. Z. 549, (Page 367). Fig. 3–4. Sympterygia acuta. M. C. Z. 632 (Page 370).

The proterygial basalia of the pectoral fins of the Narcaciontidae have numerous joints between the antorbital, *ao*, and the pectoral arch, *pct;* the Raiidae have comparatively few, most often but a single one, that is two segments in the pectoral base opposite the gills, an arrangement gaining in firmness of the disk along the sides of the branchial chamber. Marked variations occur among the genera of Raiidae. In Sympterygia, fig. 3 a semicartilaginous mass in front of the skull displaces the rostral cartilage; in Malacorhina the rostral cartilage is lacking and the forward part of the skull is much like that of the Dasybatidae. In general the hyobranchials are reduced, but the copula, *hbr'*, is complete and not segmented as in Dasybatidae nor divided as in Narcaciontidae. The scapular, *sc*, overlaps the girdle. The prominent lateral prepelvic processes recall similar ones on the fossil genus Cyclobatis.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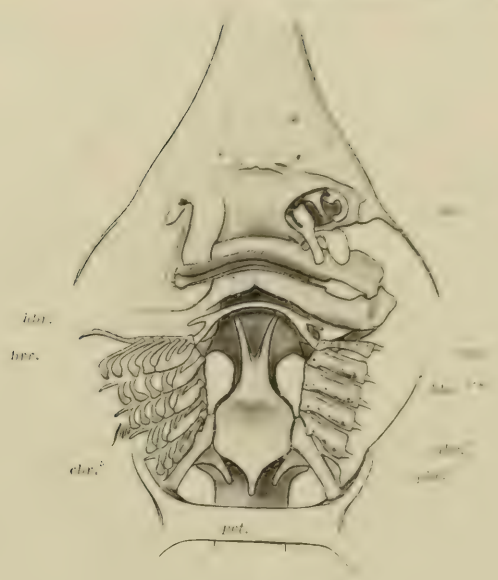
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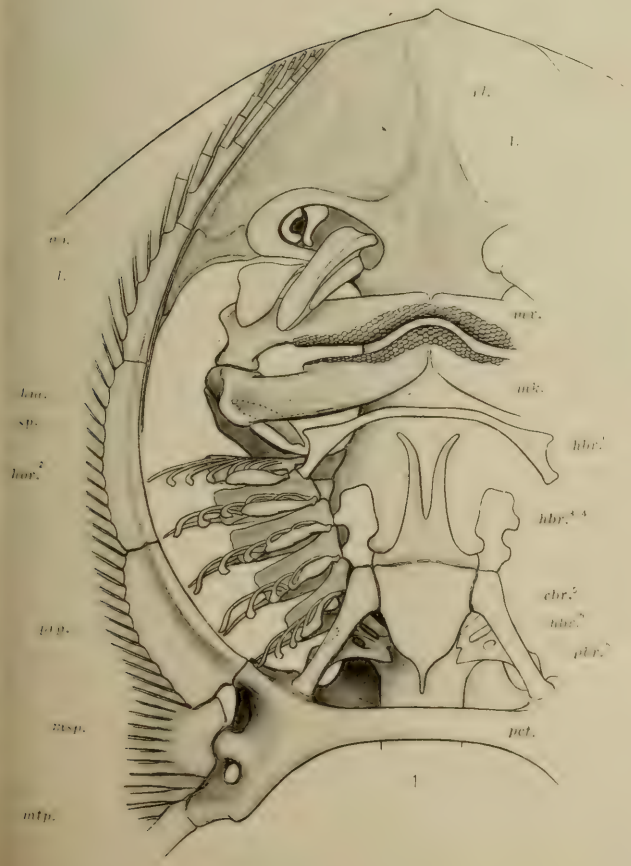
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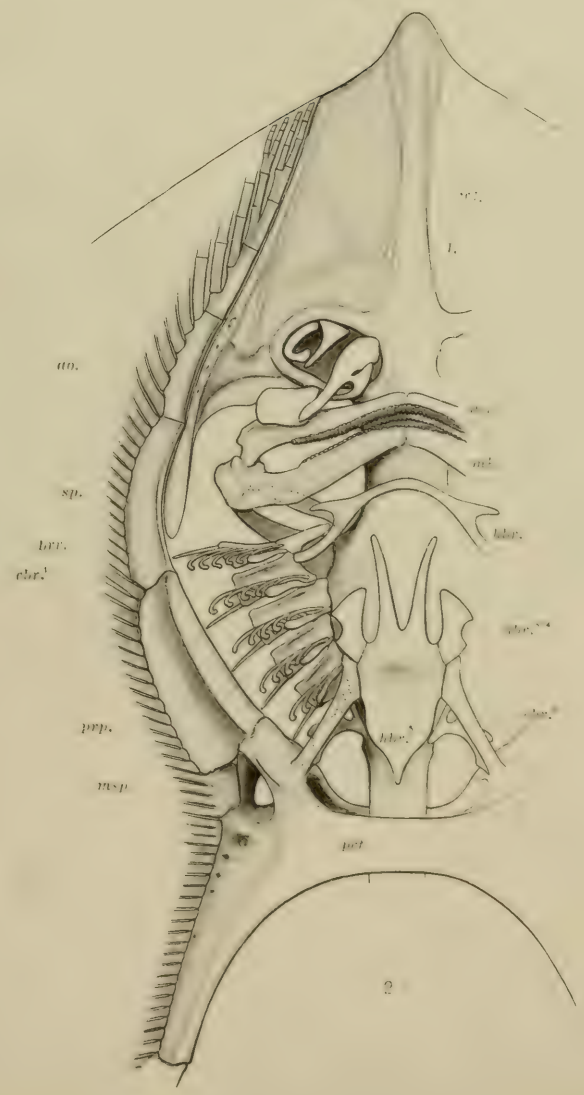
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mxp.
pet

2

PLATE 69.

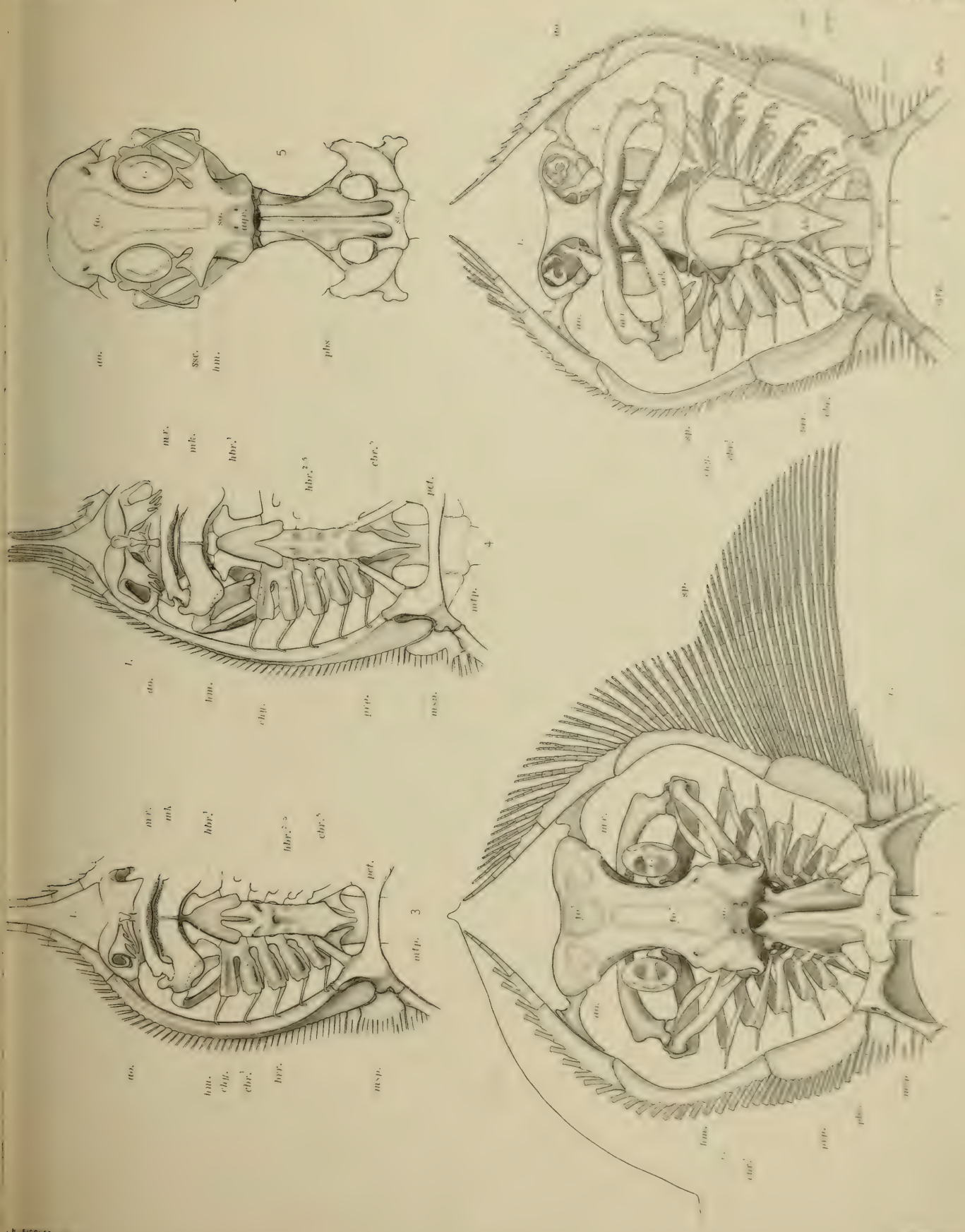
PLATE 69.

RAIIDAE and DASYBATIDAE.

Fig. 1–2. Malacorhina mira. M. C. Z. 226 (Page 372). Fig. 3. Urotrygon aspidurus. M. C. Z. 555 (Page 405). Fig. 4–5. Urobatis sloani (Page 402).

A peculiarity of Malacorhina is the absence of a rostral cartilage, the front of the skull in consequence resembling that of Dasybatus. The scapular attachment overlaps the girdle as in the other Raiidae. A feature not noticed in the others is a small movable cartilage, *x*, resting above the base of the suspensorium, a rudiment perhaps of a sometime complete arch which included the spiracular cartilages and the pterygoquadrates, the upper jaws. The copula is unsegmented and the joints in the bases of the pectorals opposite the gills are like those of the family in general.

Urotrygon, fig. 3, and Urobatis, fig. 4–5, agree in most respects with other Dasybatidae; they have no rostral cartilage, there is no joint in the pectoral base opposite the gills and the scapular articulations are against the ends of the scapula, *sc.* not above the girdle as in the Raiidae. Urotrygon, fig. 3, apparently lacks the median segment of the copula, as in the Torpedoes. In Urobatis there is a slender elongate supraspiracular cartilage.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cl'
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PLATE 70.

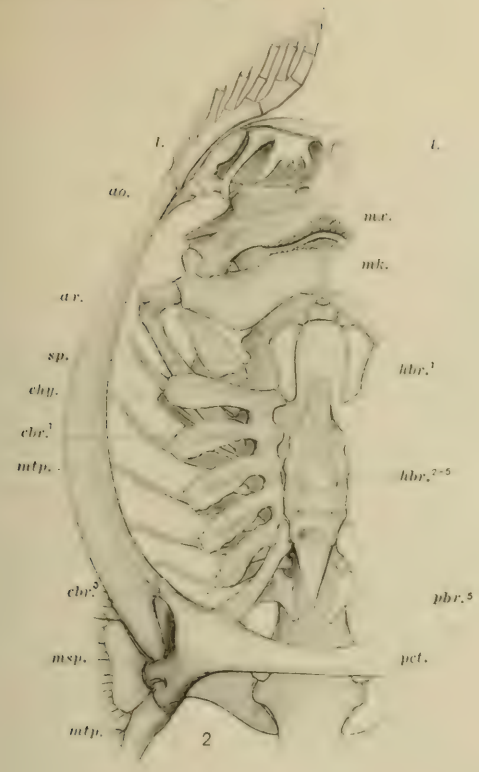
PLATE 70.

POTAMOTRYGONIDAE.

Fig. 1–2. Potamotrygon circularis. M. C. Z. 295 (Page 419). Fig. 3–4. Disceus thayeri. M. C. Z. 606 (Page 426).

1, 3. Dorsal view.
2, 4. Ventral view.

The River Trygons are close allies of the Dasybatidae. They have no rostral cartilage from the skull forward, the copula, *hbr'*, is segmented, the propterygial basalia of the pectoral fins, *pap*, are strong and in a single piece between the antorbital and the shoulder girdles, and the postbranchial stay, *pbs*, is reduced. Disceus, fig. 3, has a small hardly distinct antorbital cartilage, *ro*, a broad postspiracular *psp*, a wide bar in the shoulder girdle and short orbital processes; Potamotrygon, fig. 1, has a larger antorbital, a narrow and elongate postspiracular, a narrower bar in the girdle and longer orbital processes. In both genera the ceratobranchials are more or less solidly anchylosed. Disceus has elongate narrow opercular cartilages, *op* 1–5.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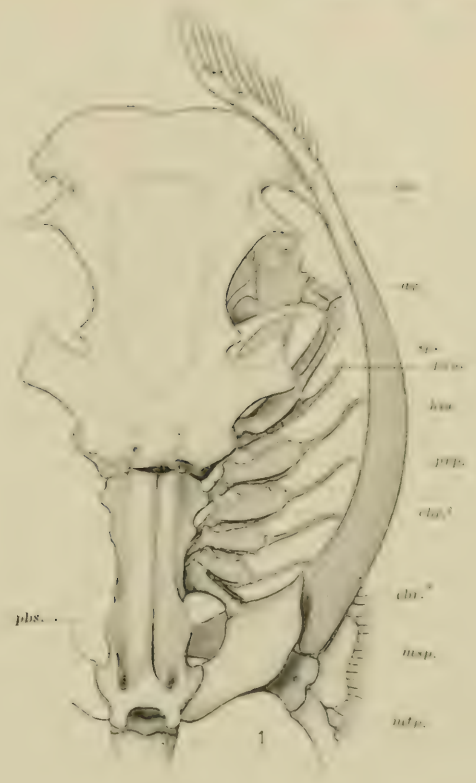
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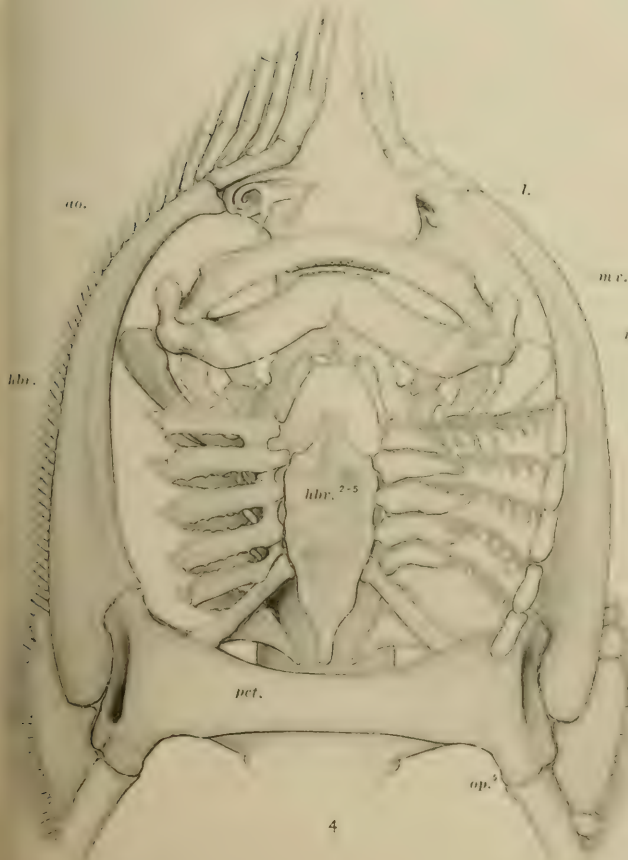
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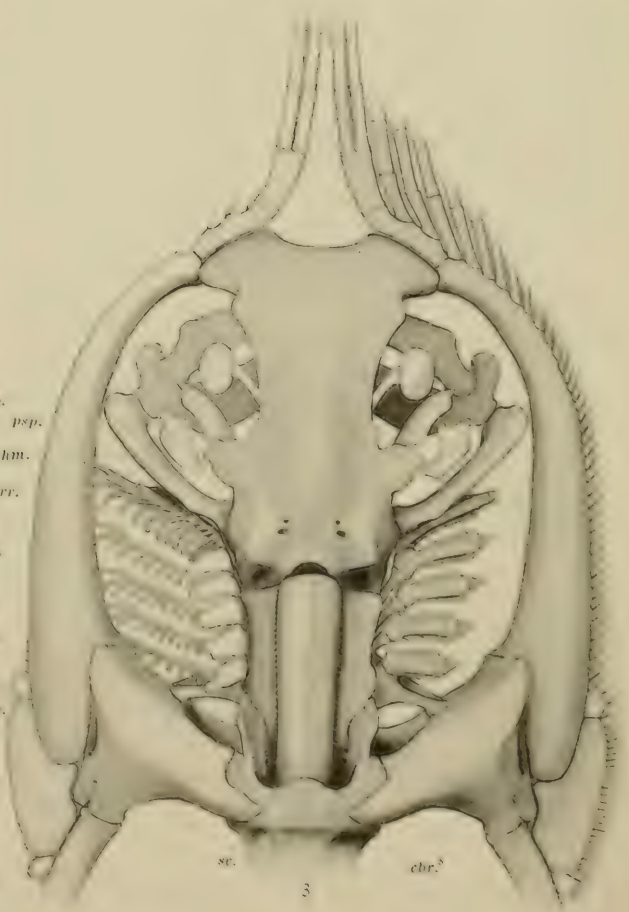
sc.
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3

PLATE 71.

PLATE 71.

DASYBATIDAE.

Fig. 1–2. Dasybatus guttatus. M. C. Z. 639 (Page 391). Fig. 3. Dasybatus zugei. M. C. Z. 23 (Page 398). Fig. 4–5. Taeniura lymma. M. C. Z. 620 (Page 399).

1, 3, 4. Dorsal view.
2, 5. Ventral view.

Rigidity of the disk around the head and the branchial chamber is secured by the elongation and firmness of the propterygial segment of the pectoral base. The copula, *hbr'*, unlike that of the Raiidae, is segmented; anteriorly, in the basibranchial portion, it broadens toward the suspensorium, hyomandibular, *hm*. The ceratobranchials are more or less consolidated and enlarged, as also the basihyals. The branchial ray, or rays, at the outer ends of the ceratohyals and ceratobranchials are attached to the bases of the pectoral at their outer ends but are not modified.

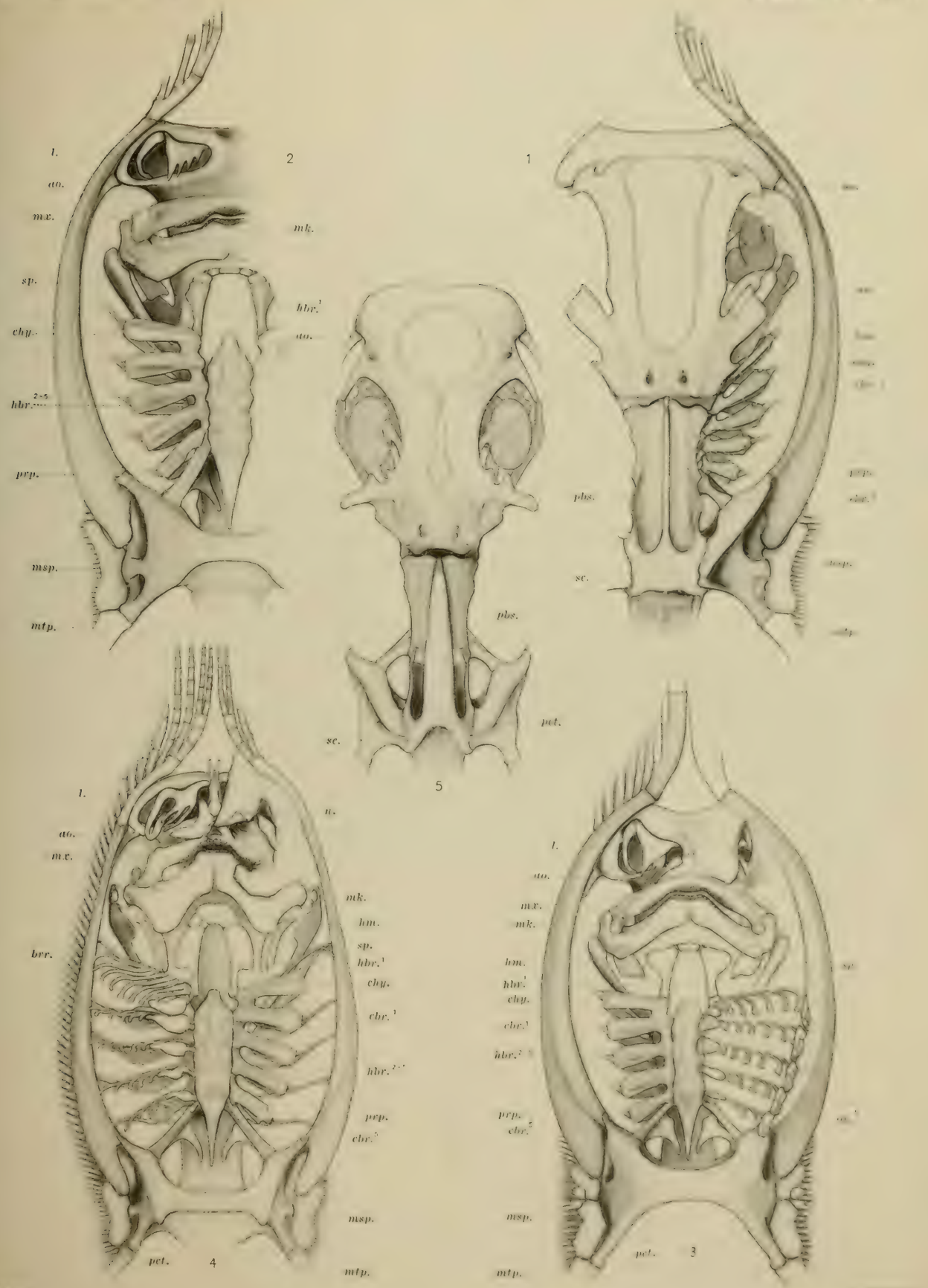
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PLATE 72.

PLATE 72.

Fig. 1–2. Pteroplatea altavela. (Page 415).

Except in what is more directly affected by the broadening of the body and the pectorals this genus exhibits no great departure from the other Dasybatidae. The copula is segmented, the propterygial segment of the pectoral base is strong and elongate and reaches slightly beyond the antorbital, the ceratobranchials, *cbr*, are fused at their inward ends, and the basihyals form a large broad shield-like plate. The shoulder girdle has been modified in several particulars; the pectoral bar, *pct*, has widened and the scapular braces to the pro- meso- and metapterygia have elongated, though the scapula, *sc*, from which they extend outward, is comparatively little changed.

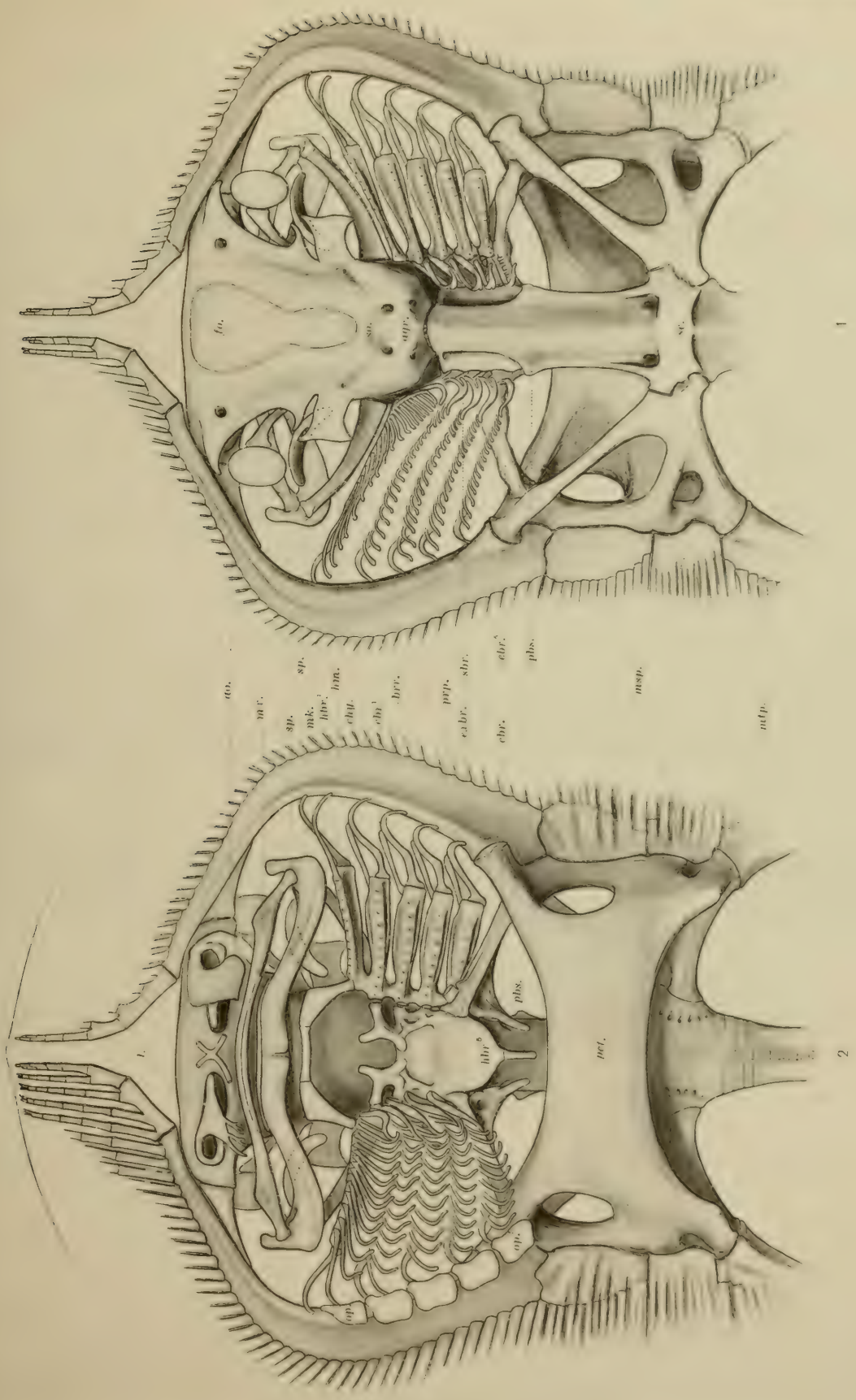
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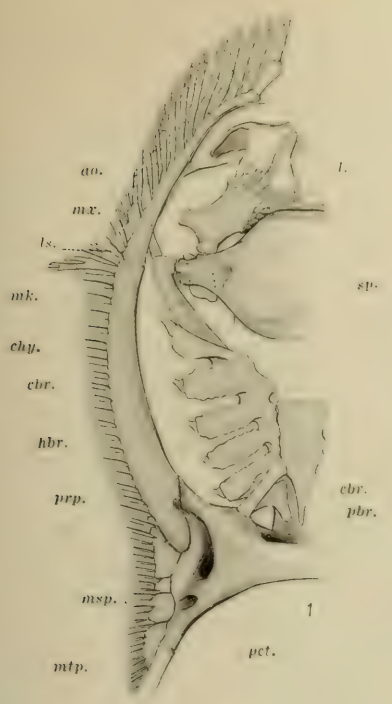
PLATE 73.

PLATE 73.

MYLIOBATIDAE.

Fig. 1. Myliobatis aquila. M. C. Z. 623 (Page 431). Fig. 2. Myliobatis peruvianus. M. C. Z. 636 (Page 430). Fig. 3. Aetomylaeus maculatus. M. C. Z. 106 (Page 435). Fig. 4. Aëtobatus narinari. M. C. Z. 677 (Page 441).

Three of the genera of the Myliobatidae are figured here. The fourth, Pteromylaeus, stands between Aëtomylaeus and Aëtobatus; it has the narrowed head and the separation of the pectorals as in the latter, but has a different dentition. Myliobatis, fig. 1, differs from the rest of the family in possessing a continuous pectoral along the side of the head, and in absence of the modification of the pectoral rays opposite the lower jaw. In all the genera the propterygial segment of the base of the pectoral extends beyond the antorbital, that is beyond the head. In the very young this section of the base appears to be somewhat irregularly segmented, but these indications are transitory, probably ancestral tokens. The branchial ray at the outer end of the ceratobranchial is slightly modified at its point of attachment to the pectoral base. The extra series of cartilages, *evs*, in front of the branchial rays along the ceratobranchials and epibranchials are more developed than in preceding families. The extrabranchials, *sbr*, above and below, are well developed; they are modified branchial rays. The opercular cartilages, *op* 1–5, are fringed. Extra cartilages, *evs*, appear upon or along the bands of the gill lamellae; these may be called epitropeal, the upper ones being supratropeals, the lower subtropeals.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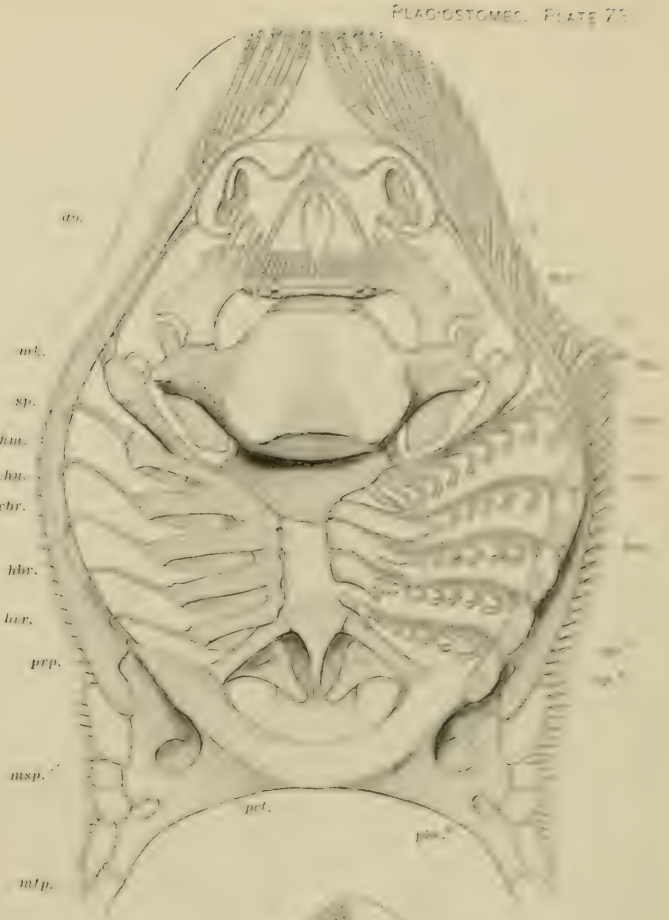
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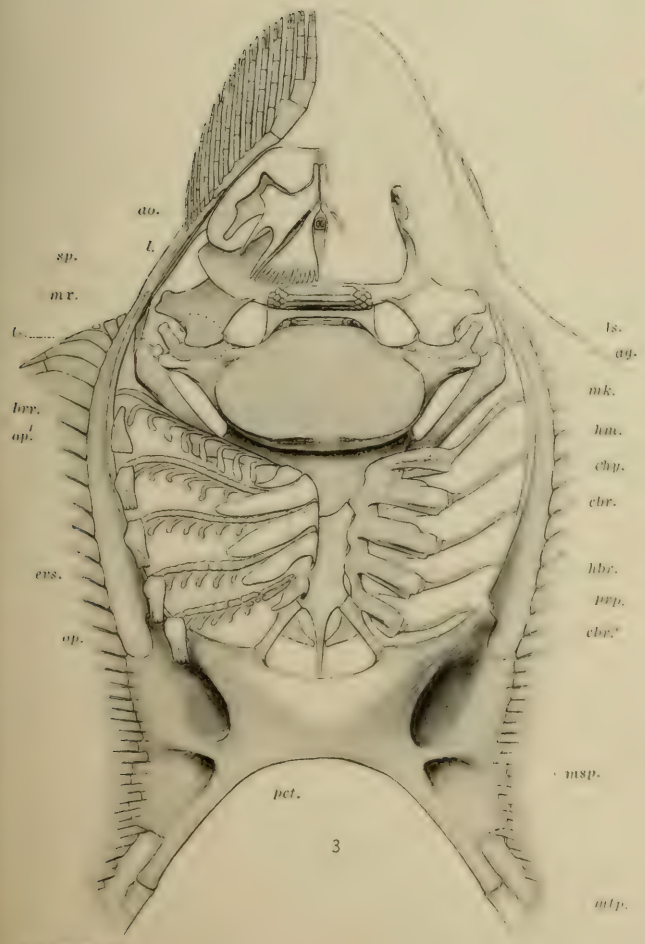
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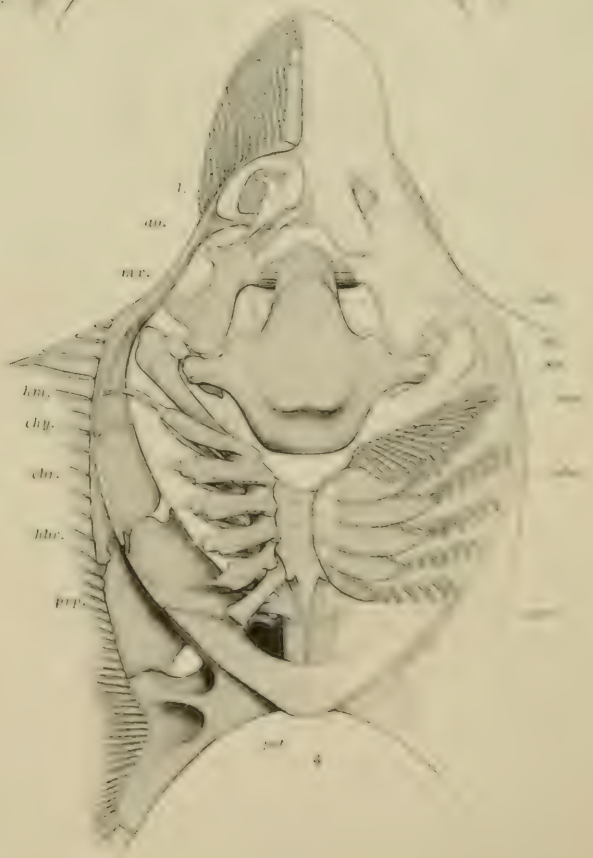
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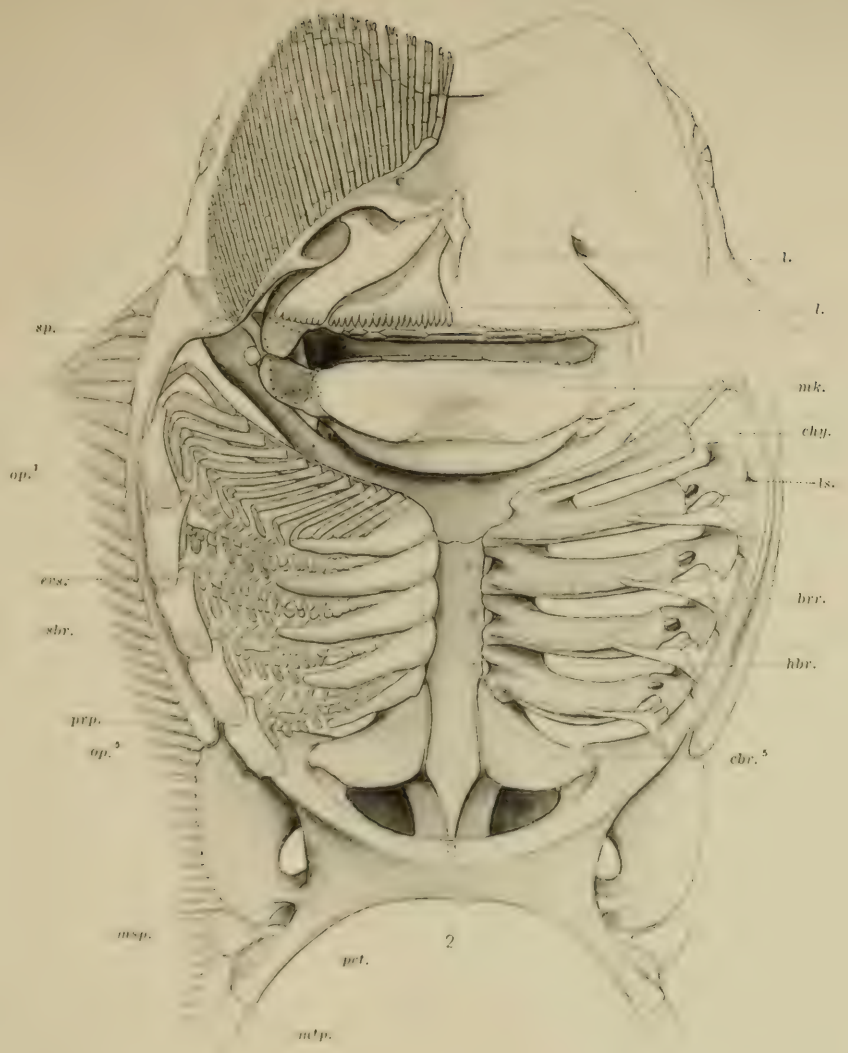
PLATE 74.

PLATE 74.

RHINOPTERIDAE.

Fig. 1–2. Rhinoptera jussieui. M. C. Z. 863 (Page 447).

The skull of the Rhinopteridae is short, broad, and somewhat indented in front. The cephalic fins are quite distinct from the pectorals, are situated at a lower level, and are not widely separated from one another in front of the mouth. The mouth is widened and the jaws are broadened, the narial cartilages are long and broad. The propterygial bases of the pectorals are unsegmented at the sides of the gill chambers, unless it be in very young stages, they are enlarged and strengthened, and to further conduce to stability and firmness the lateral stays, *ls*, *bra*, *bre*, are so greatly modified as to be hardly recognizable as gill rays; the anterior, *ls*, is directed forward over the antorbital, *ao*, as a single elongate cartilage; the second, *brr*, fig. 1, is directed outward, segmented and turned back in its outer segment; the third, *bra*, and the following show the outer segment firmly attached to the base of the pectoral while the inner segment of the ray, *bre*, is broadened and enlarged into a sort of hammer-shape, solidly attached to the ceratobranchial and the epibranchial at their junction, and also to the outer stay or segment, *bra*. The epitropeal cartilages, supratropeal and subtropeal, *evs*, form regular series above the arches, and irregular ones below them. The extrabranchials, *sbr*, supra and sub are large. The mesopterygia are much reduced or fused with the girdle, *pct*. The anterior *hm*, in fig. 1, should be *sp*. Changes in the structure of the gills leading towards Mobula are seen in the Rhinopteridae; the inward section of each lamina takes on more of the functions of protection and of propelling the food toward the stomach while the outer section is more concerned in purifying the blood, see Plate **59**, fig. 9–10.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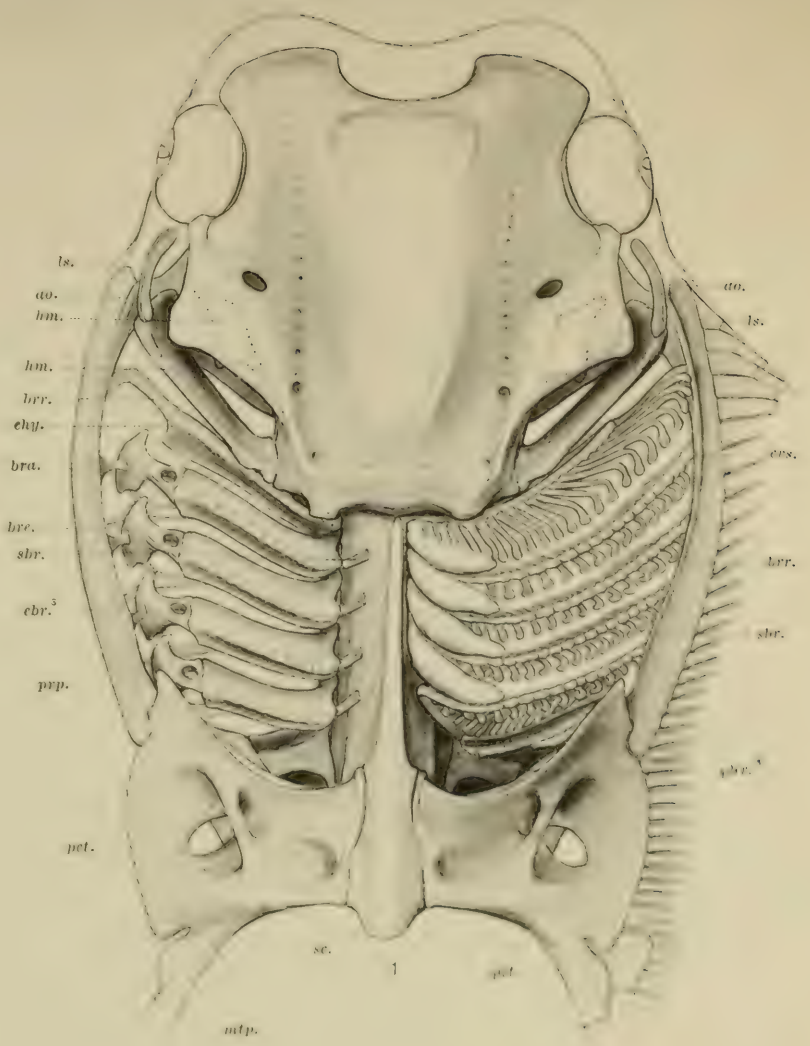
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pct.
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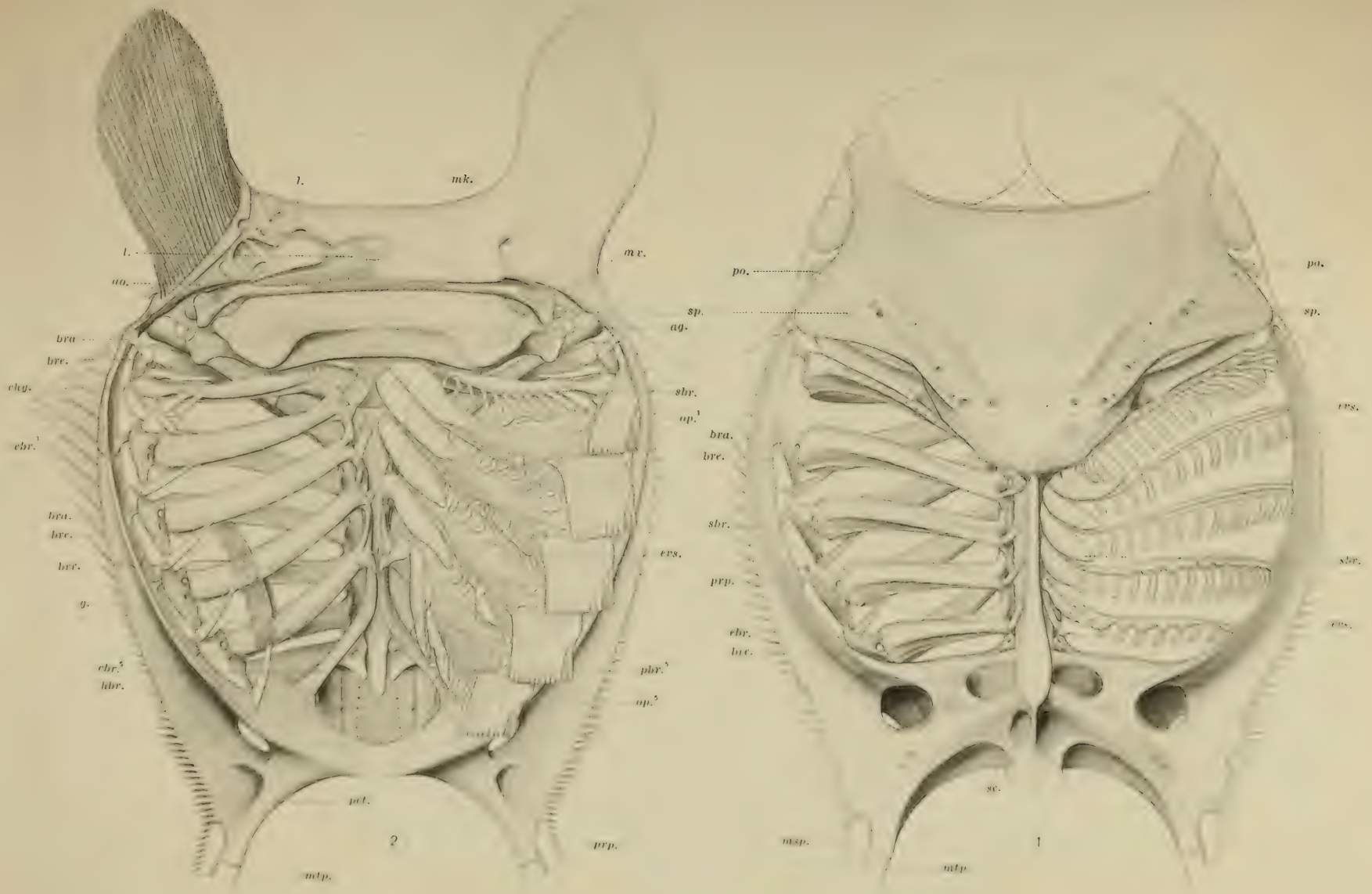
PLATE 75.

PLATE 75.

MOBULIDAE.

Fig. 1–2. Mobula hypostoma (Page 453).

A course of evolution resembling the actual course traversed by Mobula from an ancestral form like the Dasybati may be traced through Myliobatis, Aetomylaeus, and Rhinoptera by means of the pectoral and the cephalic fins — connected and meeting in front of the head and lacking the modified radials opposite the gills in Myliobatis, disconnected at the sides but still meeting in front and possessed of the modified radials in Aetomylaeus and Rhinoptera — or by means of the propterygial bases of the pectorals, or even by means of the outer branchial rays their attachments and their transformations quite as readily as by means of the dentition, the narial cartilages, or the skull itself. The cranium of Mobula is broader and more indented in the forehead than that of Rhinoptera. The cephalic fins are distant from one another in front of the head; they are radically separated from the pectorals, the anterior rays of which latter have undergone considerable changes of form. The mouth is widened; the jaws are elongate. The outer branchial rays are transformed into braces or stays, *ls*, *bra*, *bre*, in a more firm attachment of the gill arches. The extrabranchials, *sbr*, are highly developed; originally they were branchial rays, and they do not closely correspond with the extrabranchials seen, on Plate **51**, fig. 2, or on Plate **62**, *exbr* and *sbr*, in the shark. The stays *ls*, *bra*, *bre* originated as noted under Plate **74** for those in Rhinoptera. The second ray from the outer stay is lengthened, wider outward, and has a slender curved extremity; it also serves as a brace. Nearly all of the rays on the ceratohyals, *chy*, are segmented and more or less changed in form. The long strips of cartilage, *evs*, first appearing as small lumps and later fusing, upon the bends in the gill lamellae, parallel with the gill arches, are adventitious and are first noted in Myliobatidae, Plate **73**; they are named *epitropeal* cartilages, the upper *supratropeal*, the lower *subtropeal*. The opercular cartilages, *op* 1–5 attain their maximum development in this family.



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OF THE

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AT

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